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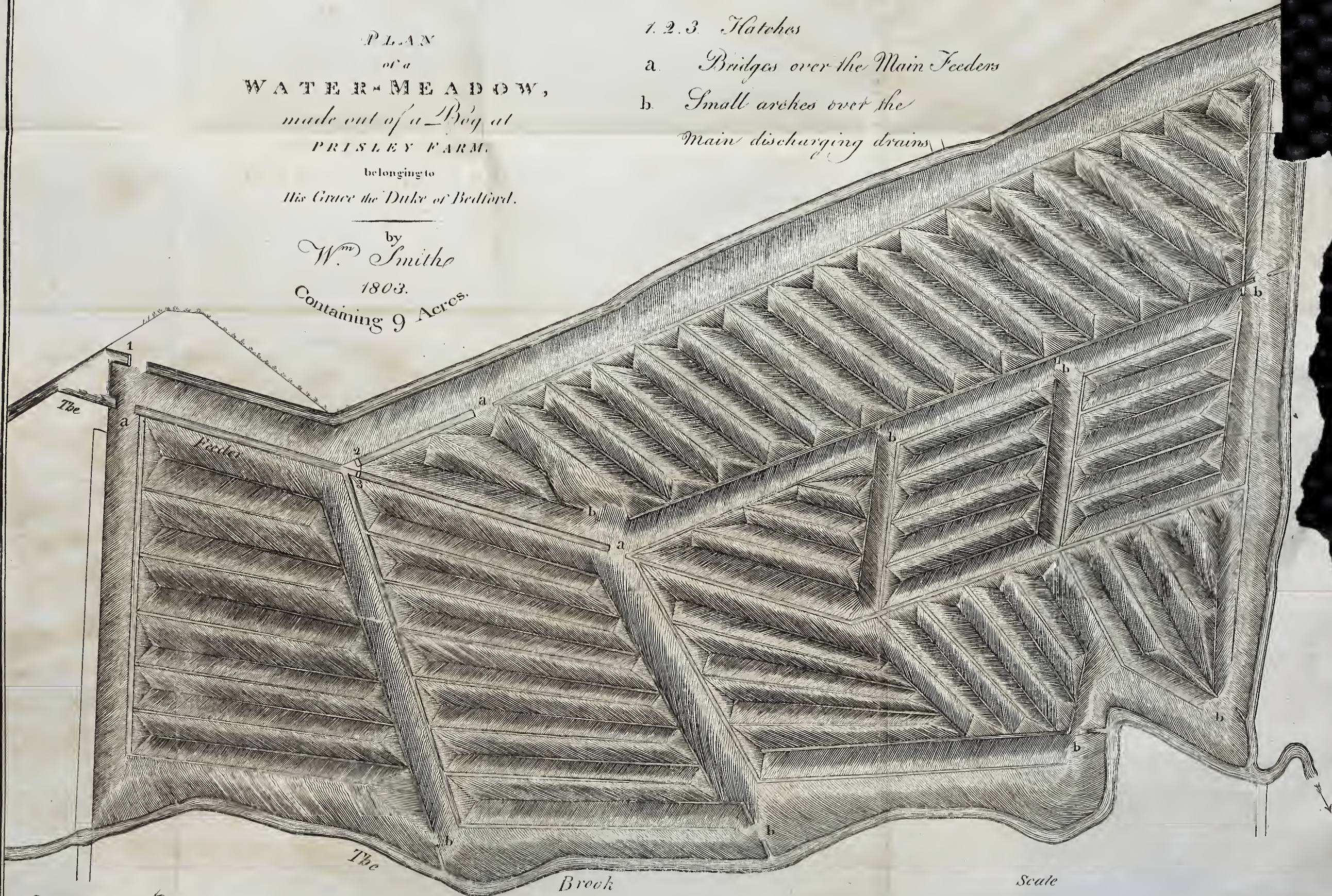
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PLAN
of a
WATER-MEADOW,
made out of a Bog at
PRISLEY FARM.
belonging to
His Grace the Duke of Bedford.

by
W^m Smith
1803.
Containing 9 Acres.

1. 2. 3. Hatches

- a. Bridges over the Main Feeders
- b. Small arches over the
Main discharging drains



W^m Smith del

Scale

0 1 2 3 4 5 Chains

OBSERVATIONS
ON THE
UTILITY, FORM AND MANAGEMENT
OF
WATER MEADOWS,
AND THE
DRAINING AND IRRIGATING
OF
PEAT BOGS,
WITH
AN ACCOUNT OF PRISLEY BOG,
AND OTHER
Extraordinary Improvements,
CONDUCTED FOR
HIS GRACE THE DUKE OF BEDFORD,
THOMAS WILLIAM COKE, ESQ. M.P.
AND OTHERS;
BY WILLIAM SMITH,
ENGINEER AND MINERALOGIST.

NORWICH: PRINTED BY R. M. BACON, COCKEY-LANE; AND SOLD
BY LONGMAN, HURST, REES, AND ORME, PATERNOSTER-ROW,
LONDON; AND ALL OTHER BOOKSELLERS.

1806.

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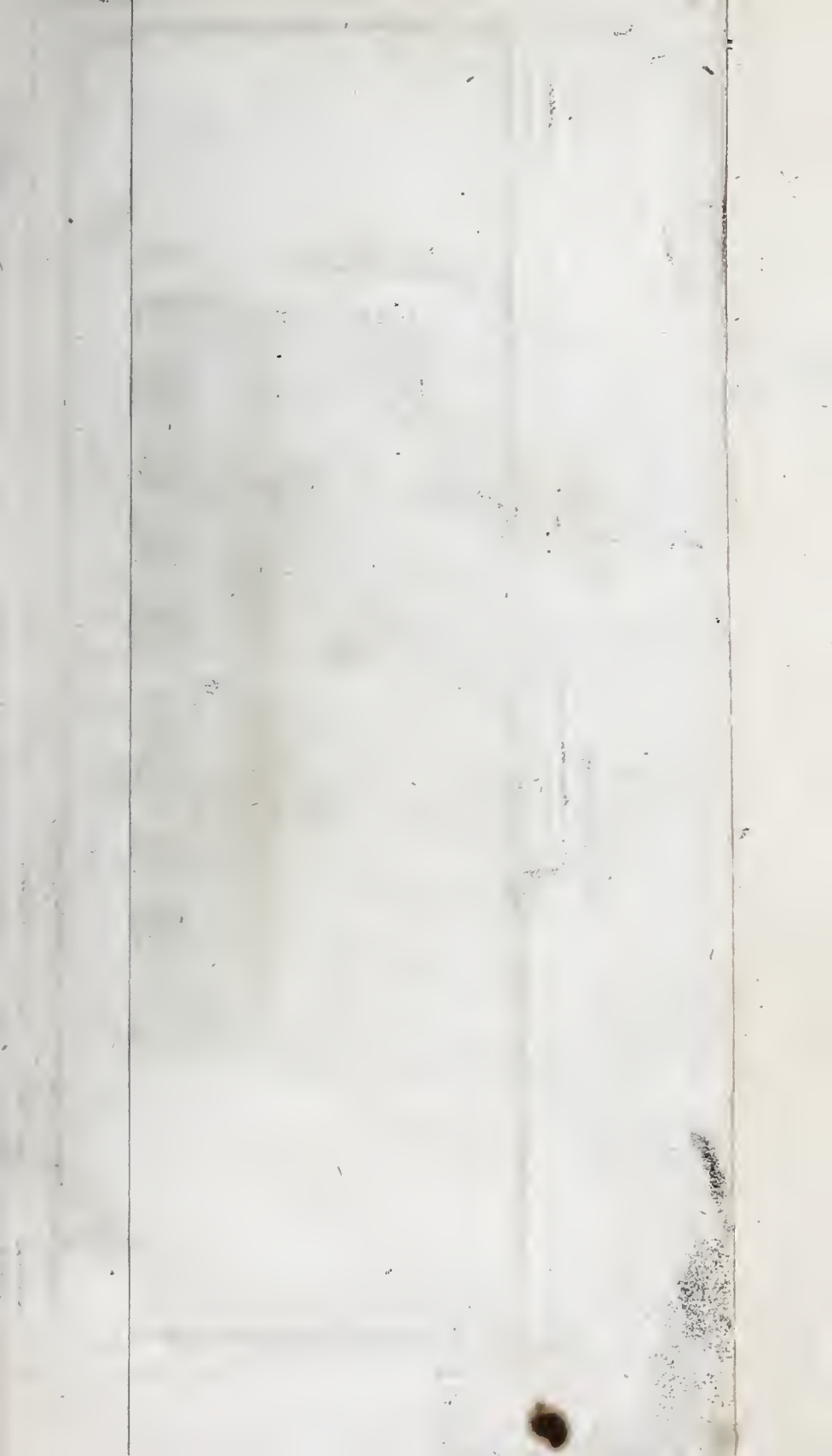
CONTENTS.

	Page.
<i>Dedication</i>	1
<i>Preface</i>	7
<i>Introduction</i>	13
<i>The Origin and Antiquity of Water Meads</i>	19
<i>Their Advantages</i>	30
<i>Their Formation</i>	41
<i>Their Management</i>	58
<i>Low Meads and Marshes</i>	79
<i>The Prisley Bog</i>	94
<i>Various Water Meads</i>	111
<i>Lexham Water Meads</i>	112
<i>Ancient Water Meads</i>	116
<i>Conclusion</i>	118

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*HAS Albion yet no wide extended moors,  
And long meandering streams which turn no mills,  
Nor float her numerous richly-laden barks,  
But with wild foaming waters idly chafe  
Their crooked channels, as they hurry down  
To Ocean's wide and multitudinous waste,  
Or into one irriguous ruin sweep  
Whole plains of marshy mead, which art and skill  
Might soon to fields of wavy corn convert,  
And reed and rush to gayest verdure change,  
To fatten fleecy flocks and sturdy steers?*

~~~~~

The Feeder

1 2 3 Flatches
a Bridges over the
Main Feeders
b Small Arches over
the main discharging
Drains.
c The small Trunk.

The

Brock

W. Smith del.^r

Scale

Chains

TO

Thomas William Coke, Esq.

Member of Parliament

FOR THE COUNTY OF NORFOLK.

SIR,

AS no one can be more capable of judging of agricultural improvements, than you who have already been the means of promoting so many, I flatter myself that the addition of your name to this work will have greater weight with the public, than any other. I have been the more anxious to obtain that favor, as the practice of Irrigation is most admirably calculated for the county in which you have so long and happily resided, and in which you are most materially interested. You have also been an eye witness to the benefits derived from the practice of Irrigation, by more than one

of your most respectable tenants ; and I am happy to find many persons of the first rank, very desirous of promoting similar improvements to those which I had first the pleasure of successfully conducting for Mr. Reeve.

Mr. Overman and Mr. Beck, now your tenants, are men with whom it is an honor to be acquainted, and whose laudable zeal to excel in every branch of agriculture most useful to society, has induced them to adopt the practice of Irrigation. I am sorry that the former of these gentlemen has not a situation for the purpose, equal to his desert, or I am convinced that his extraordinary genius, and uncommon perseverance, would soon carry Water Meadows to their highest pitch of perfection. Mr. Beck luckily has an excellent situation for irrigating, and which, by his good management, will soon be rendered equal to any in the kingdom, both for early spring feed and a luxuriant growth of hay. It is still more pleasing to observe, that your worthy example has not been confined to

the practice of your own tenants, or to that part of the county. Mr. Branthwayt, of Taverham Hall, near Norwich, and Mr. Motteux's tenants, at Beechamwell, near Swaffham, are busily employed in the same pursuit. Mr. Purdy, of Egmere, entered the list of Irrigators some years since, and received one of the annual cups you have so laudably given to promote the improvement of herbage on soils, which in their neglected state are of little or no value; and Mr. Money Hill will soon become a competitor, upon lands belonging to his brother. I have also received several applications from others in distant parts of the county, for the plans and execution of similar works. Indeed the recital of these good practices is nothing but a faint echo of what the community is indebted to you; but those only who live in the county of Norfolk can form any idea of the great good that is there going on, and the ultimate advantages of your invaluable improvements would to many appear like a romance, especially if put down in numbers, which is the only way of ascertaining their real

worth. It affords me great satisfaction, to see that the practice of Floating Meadows, according to the best approved principles, has already made such rapid progress in Norfolk, and I have no doubt but many similar plans of utility will speedily be executed, and that their inestimable benefits to agriculture in general, will render them some of the most lasting monuments to the memory of him, who is more beloved and respected by a larger proportion of the inhabitants of his own county, than can be said of any other individual of any county in the kingdom. Every one who is acquainted with Norfolk, knows this is not flattery. It will, I trust, be a further excitement for others to imitate, even on the smallest scale, your laudable example, to know that on the 12th of March, 1806, the board of agriculture voted their gold medal to you, for the extensive quantity of land you had irrigated, and for the very successful mode, by which a tract of unprofitable, boggy and gravelly soil, in Norfolk, was converted into sound and excellent water meadows.

That you may, Sir, live long, to enjoy the reiterated good wishes of such a large and respectable body of men, and that your example as a landlord, and their excellent practices in cultivating the soil, may be soon extended to all other counties, for the general improvement of agriculture, and the particular benefit of the landowners and occupiers and the common increase of the necessities of life, is the sincere wish and anxious hope of him who has the honor to subscribe himself,

Your obedient and obliged servant,

W. SMITH.

PREFACE.

FEELING myself highly flattered, by the encomiums passed on the important improvements in the Bog at Prisley, near Wobourn, which some few years since I had the honor of conducting for His Grace the Duke of Bedford, I am induced to hope that these remarks, on the subject of a more general improvement of landed property, by means of Draining and Irrigation, may not be unacceptable to the public, nor unworthy the patronage of the many distinguished persons by whom I have been employed to put these ideas in practice. If I could have felt the same confidence in writing that I have in Draining and Flooding, this Essay might have made its appearance sooner; but I find less difficulty in directing the labours of the spade, than those of the pen. Nature and truth are certain guides to science, and having succeeded in establishing useful experiments, by a strict adherence to the former, so I may hope to accomplish a simple detail of those experiments, by means of that plain language which the latter requires. The want

of the knowledge of lines and levels, in the generality of our farmers, may enable us to account for the neglect of the important aid they afford; and there can be no doubt but it would be much better for society, and much more conducive to improvements in agriculture, if farmers' sons were well instructed in practical geometry and the use of mathematical instruments, with the principles of machines intimately connected with their profession, instead of spending their time in learning latin, or pursuing other studies, for the attainment of which, not one out of a hundred has any occasion.—This mis-application of time in early youth, is of much more consequence to society, than one half of the world is either aware of or inclined to believe. Youth is the time for collecting the useful information which lays the foundation of that knowledge, which is so highly beneficial to ourselves and society—for any man who employs his thoughts, may have an opportunity of making many serviceable observations, and suggesting hints for the purposes of improvement, without being educated as an author.—This has been my own case; the stile of this little essay may therefore claim an unusual indulgence from those who criticise the works of the press; especially when it is considered that I am only writing to plain men on a plain subject. If my language be intelligible to them, it is all I can hope or expect. It is now about five years

since I was employed by His Grace the Duke of Bedford, to survey the wet parts of the park at Woburn, and those of some of his Grace's farms in the neighbourhood. I was immediately and strongly impressed with the practicability of improving the bog at Prisley, and I must confess I was the more anxious to try my skill upon it, when I was informed that this was the spot where Mr. Elkington's method of draining was put to the test, and for which attempt he received a large parliamentary reward, and a private douceur of considerable value from his employer. Having now, I flatter myself, fully convinced his Grace the present Duke, and many other eminent agriculturists, of the practicability of the plans which I then recommended, I have ventured (under the honor of his Grace's sanction) to lay them before the public, with a sincere hope of rendering my plans and ideas equally serviceable to many others possessed of similar situations, and I form sanguine expectations, from the very flattering encomiums of the first judges who have seen those incredible improvements, that some account of that bog which once claimed the notice of the public, will not now be unacceptable. I am also the more desirous to bring the practice of Draining and Irrigation into general use, because the late scarcity and the pressure of the times, has called aloud for every improvement that can be made

in landed property.—Trade has already gained too great an ascendancy over the landed interest, and engrossed too much of our capital. The manufacture of goods which depend on a foreign market for sale, we have lately experienced, may be rendered very precarious by the checks of our enemy; and while we are compelled to send foreigners such immense sums of money as thirty millions sterling, for grain to feed our manufacturers, which has been the fact within the last 14 or 15 years, he may be further enabled to injure our trade and the manufactories, by starving the people employed.—That we lately verged on a famine will not readily be forgotten; and while there is such a large proportion of wet and cold late vegetating land in this island, as to lose much of its produce by a few rainy summers, ought we not to exert our utmost abilities to remedy these defects in our soil, by Draining and Irrigation?

The following remarks have been the result of several years' practice in the setting out and forming of water meadows, in various parts of the kingdom, and the observations partially communicated by a correspondence on the subject, with the noblemen and gentlemen who have confided in my abilities to serve them. I was desired by the late lamented Duke of Bedford, some time previous to his death, to collect my scattered observations on the subject, and to publish

them—His Grace observing, that such a work would contain nothing but the result of observation and experiment, and a plain recital of what has been done by a strict attention to the good management of some of those water meadows, which, by such artificial means, have been rendered the most productive land of any in the kingdom; and that it is to be hoped these examples may stimulate others to adopt the same excellent improvements—since there is no crop that a farmer can cultivate, which is so much at his command, as that grown upon a water meadow.

INTRODUCTION.



*Where barren moss or thistles only grow ;
Where bogs their brown and useless herbage shew ;
Where burning suns and dusty blowing sands
With poverty o'erspread surrounding lands ;—
In meads where stagnant waters starve the soil,
There prove thy art, and there direct thy toil.
Tho' nature on thy infant efforts frown,
Rich plenty shall maturer labours crown !
If art and science point the prudent way,
Where flocks and herds their annual tribute pay.*



THE abundant supply of spring water, which is constantly issuing from the basis, sides, and even near to the top of the highest hills and mountains in this kingdom, is one of the greatest blessings bestowed on the animal and the vegetable creation : but this, like many other things left to the care and cultivation of man, may, by idleness, inattention and mismanagement, become one of his greatest evils, and retard his agricultural improvements, more than all the noxious weeds and insects with which his crops are infested. On the contrary that water, which in its natural course or current, is a nuisance to all the land it passes

over, by proper draining and directing into a new channel, may be often applied to the most useful purposes, with the same trouble and expence, and even perhaps for a less sum than is generally expended upon injudicious methods of draining and floating.— It is an evil of great national importance, that the direction and execution of this branch of agriculture has so long been entrusted to those whose situation in life cannot afford them an opportunity of extending their ideas further than the very spot they are employed upon. It cannot be supposed that such men have any general notions of strata, nor can they judge with that degree of accuracy which a more enlightened person might do, where to search for water, the beds of stone or gravel through which it filters, or the strata of clay, &c. which are the cause of its appearing at the surface. It is therefore evident, that too much caution cannot be used in draining, which may properly be called the foundation of good husbandry; for no system of cropping, manuring or watering, can have the desired effect, till this business is completely accomplished; the presence or absence of the water frequently making all the difference between land that is naturally good and that which is bad. Much of its vegetating power also depends upon a due proportion of this fertilizing fluid;—it therefore requires the greatest skill and attention in the irrigator, to know where and when to draw off the redundancy, or supply the deficiencies of nature, in this respect; but nature in this case, as well as most other agricultural concerns, has given us the best clue to such necessary information. All lands that have had an extraordi-

nary quantity of moisture on them in the winter, will always shew its effects early in the spring; and this is the time to judge, whether the water properly applied would be productive of good or ill, upon such soils; for whatever be the effect, it will then be very visible, and will require no extraordinary judgment to decide upon its merits. If it has run over a cold clay, which perhaps was too wet before, it will make the grass of a bluer hue, and render the quality worse than any other part of the field. Wherever water produces such an effect, it is certainly upon the most unfavourable soil for floating; yet with proper management, even such an uncongenial soil, may be much benefited, and probably equally, or even more, than by any compost or top-dressing, which can be given to it. That ground which gets soon wet and soon dry, will vegetate early, and soils that retain the winter moisture too long in the spring, will always shoot late at the beginning of the year; but such soils, for the same reason, will hold out the longest in a dry summer, and produce the most grass in autumn, when the quick-growing lands will be burnt up. Of the two soils, that is certainly the most desirable, which will produce the most grass at an early season of the year, when hay is nearly finished and green feed is much wanted to increase the milk of cows that calve early, and for the support of sheep and young stock. This distressing season is therefore the time, when water meads have such evident advantages over all other lands. Yet however desirable those improvements may be, I know that there are many obstacles in the way of making them, even in

places where the advantages of irrigation are well known, and have been long practised in the neighbourhood.

In some cases there is not fall enough in the water, sometimes other lands intervene between those to be flooded and the place where the water must be taken out of the river; and it too often happens, that the water does not belong to the same person as the land, and too frequently the villages and farm-houses stand in the very place where the water meadows ought to have been made. All these obstacles to a system which wants no advocate to plead its utility, are too commonly found in many of the Wiltshire bourns or valleys. It may appear extraordinary to persons not apprized of these local circumstances, that there are not more water meadows in Wiltshire, or rather that any should remain to be done, since the fertilizing qualities of water have been so long known, and highly extolled in that county.

Most of the towns and villages, in the dry part of Wiltshire, have evidently been placed in the bourns, for the sake of easy access to water; and it must be a work of time to remove them; but if all the advantages that would accrue to the farmer, in consequence of such an alteration, were to be brought into account, I am inclined to think it would answer the purpose to do it in some situations I have seen. Most of the buildings in this part of the county being composed of little more than mud walls, it would be folly to rebuild those that go to decay in the same inconvenient places. I should therefore recommend all landowners, who have property so circumstanced, to have

the whole lands surveyed, and the levels taken and accurately laid down upon the plan, with all the principal lines of the feeders, drains, &c. that would be necessary to float the land when the buildings were removed; and such a plan well digested, with proper places fixed upon for rebuilding the farm-houses; &c. as fast as they are dilapidated, should be handed down from father to son, till the whole design be accomplished. Accurate surveys and levels of all low lands should also be taken previously to any application to parliament for the purpose of draining and improving, that proper clauses may be introduced, to enable the commissioners of inclosure or proprietors of the land, to derive the full benefits of a judicious management of the water; for all low meadows, or large districts of land, which lie contiguous to rivers, and are subject to be flooded by fresh water, may reap the advantage of a double improvement by draining and irrigating. In situations where the water flows on and off the land at certain seasons of the year, the assistance of art will accomplish both these circumstances at any time, and in those quantities which shall be most convenient and manageable. I know that land-owners suffer much in many low situations for want of the liberty of making a straighter or deeper outlet for the flood through some other land, or by the side of a mill which does not belong to them.—But I see no reason why the legislature should not grant one general power to improve all lands of that description, by cutting such drains as in the opinion of able engineers and commissioners shall appear to be necessary, and that the damage done by such drains and the value of

the land occupied by them shall be settled by commissioners or a special jury.

It too often happens that a miller, who has no other property in the parish than his mill and his water, takes a pride in penning up that water to the annoyance of his neighbour and the great damage of some of the best lands, and he is generally supported in this by some prescriptive right which people do not care to litigate, for there is nothing more uncertain than the determination of disputes depending upon the laws respecting water and water-courses. Any one who should bring about a revival of those laws by which streams of water may be better regulated, would merit the thanks of his country. I could enumerate many instances where the water-mills do much more damage to the land than they are worth



THEIR ANTIQUITY AND PROPER SITE.

*The verdant meads by labour form'd,
With genial streams thro' winter warm'd,
Put forth their March and April shoots,
To vie with May's luxuriant roots.*

THE high antiquity of water meadows, and the great utility of them in Wiltshire, renders it matter of surprise, that they have not yet been more generally adopted in every other county. The deficiency of that particular information amongst farmers, and more especially the want of a better knowledge of levels, are reasons why this practice, evidently advantageous, should have remained so long neglected, and why the utility of water meadows has been chiefly confined to the western parts of the kingdom, when there are many others which equally need this assistance, and where water and soils of nearly the very same quality abound.

A water meadow is a piece of ground so formed by nature or art, that water may flow quickly over its surface, for the purpose of promoting an early

and increased vegetation of grass. There are but few natural water meadows, and Wiltshire has to boast of some which probably gave the first idea of making them artificially—hence we may be enabled to account for the origin of a practice which has been extended over a great part of that county. But why a discovery so conspicuously advantageous to agriculture should have been so long confined to such a small district, may be more difficult to explain. Dorsetshire, Devonshire, Hampshire and Gloucestershire, have also many meadows that are floated, but the practice is more extensive, and probably (for the reasons before assigned) more ancient in Wiltshire than in any of the other counties. The general want of good pasture lands in the high grounds of Wiltshire might be a great inducement to improve those watery vallies which must ever have exhibited the most flattering appearances of early and luxuriant vegetation. The advantages of water, in such a country, could not remain long undiscovered, and those advantages are rendered much more eminent here than in any other place, by being contrasted with the brown and stunted herbage of the adjoining downs.

It is not uncommon in Wiltshire to see lands, where water has been diverted for the purpose of improvement, divided by a hedge or drain only, the grass on one side of which is of the most luxuriant nature and abundant growth, but on the other so diminutive that its strongest blades have never reached the height of three inches. Having been much accustomed to make particular remarks on the appearance of the country, in the course of numerous and extensive

journies for the purposes of business and collecting information on the strata, it may not be amiss to point out some of the places which appear to be equally calculated for improvement by irrigation. I flatter myself, from the many successful experiments in the art of irrigation which I have established in different parts of the kingdom, even upon soils and with water which was formerly considered to be unfit for that purpose, that the prejudice against the quality of the water or soils to receive it will now be done away. I have no doubt but the failures in irrigation have arisen from bad management, rather than from any fault in nature. These errors will be clearly pointed out, under the different heads to which they belong, I shall therefore go on to enumerate the places which are most sure to succeed. By the same system which I should recommend for draining the fens in the counties of Lincoln, Norfolk, Cambridge and Northampton, large quantities of land upon the skirts of those fens might be converted into the most valuable water meadows; a considerable quantity of land on each side the rivers, where they pass through the adjoining counties of Bedford and Suffolk, might also be made into water meadows by removing the inconveniences of floods. To such a tract of poor lands, as the western parts of Norfolk and Suffolk exhibit, water meads must be invaluable; and though a large proportion of these districts are well supplied with water, yet there is little or no water meadow in the country:—but if the owners of these poor lands regard their own interest, none of that description should be appropriated to any other purpose. The present occupiers of these, as it were,

shifting sands, know that their soils cannot be managed without sheep, and the provision for the large flocks kept there is attended with great uncertainties, arising from the failure of turnips and artificial grasses, the farmer must consequently suffer great losses. Even the largest streams, in a situation like this, should be made to distribute their waste water over whatever land it can be made to cover; for all other uses of the water, except navigation and irrigation, ought to be dispensed with, and the land owners would in such cases better serve themselves and the public, by an application to parliament for powers to float their lands instead of inclosing them. The expence of the latter is not repaid in many years, and upon the poorest lands the landlord is never reimbursed; whereas the expences of irrigation would be amply repaid in the second or third year.

It would be no difficult matter to prove by calculation the great national benefits to be derived from the introduction of a better system of draining and irrigation—the subject is consequently worthy the notice of the British legislature. Improvements would become most general under the powers of a specific act, granted for the purpose of promoting all the benefits to be derived from such works. There are many instances where these powers are not wanted, many where the expence of obtaining them would be greater than the improvement itself. Hence it is not likely to be effected by individual application; in a national view, it is most indisputably worthy a general act.

It will be impossible to form any exact estimate of the probable expences of making a water meadow.

Much depends on the original state of the ground, the size and fall of the stream to be used, the cost of hatches, and length of the main feeders which may be necessary for diverting the water out of its original channel, and even upon the charge for levelling land, which differs materially. Some soils are much harder, and more difficult to move than others, and in certain situations, building materials are very scarce and dear. This last circumstance must make a considerable variation in the price of the hatches, where the stream is large. It is also impossible to tell with any degree of certainty, what proportion these expences should bear to the quantity of land irrigated, for some situations will require much more masonry than others.

Water, like fire, is said to be a good servant but a bad master, and it is not easy to tell which commits the greatest ravages. Water in its full force and abundance is certainly the most difficult to conquer; hence the necessity of possessing the complete command of all water applied to the purposes of improving land. Temporary means of making dams and hatches to divert the water out of its usual channel may suffice to try an experiment, or for a tenant who has but a short term on the grounds to be irrigated; but every land owner who enters upon such works in this temporary manner, sadly mistakes his own interest; indeed it is very frequently more difficult to repair than to renew upon large streams, when the foundations are often destroyed by the force of the water. The same principle holds good upon small streams, and even in the drains and feeders of a water meadow. Wherever the channels are so contracted as to make a fall or

much increase the rapidity of the stream, it is constantly disposed to wear away the sides of its channel, or undermine a dam. To repair these defects, land must be dug away and wasted each time it is replaced, with the loss of labour. The consequent ill-management of the water renders it more advisable, and perhaps cheaper, to make all such works of masonry. When works are well done at first, the owner ever finds a pleasure in viewing them; and even the labourers feel much more interested in their good management. Much of the success of irrigation depending upon proper management, this is a consideration not to be overlooked.

Artificial irrigation is produced by diverting the water of a brook out of its accustomed channel (where there is a fall) in such a manner that the new water-course being kept nearly level, the space between the old and new channel may be floated—the water being brought upon the land by the new channel, and taken away by the old one.—Thus a constant discharge and succession of water is retained without such an accumulation as would make it appear bright upon the land, or without such a deficiency as would leave any part of it not perfectly floated; for the art of irrigation may be most properly called floating, not soaking nor drowning. Soaking the soil, similar to the effect produced from a shower of rain, is not sufficient for the general purposes of irrigation; nor will damming up water, or keeping it stagnant upon the surface, like that in a pond or on the fens, produce the desired effect.

The latter may properly be called drowning, be-

cause it drowns or covers all the grasses, thereby rendering the plants beneath it certainly aquatic, or the herbage disposed to make such a change; whereas the herbage of a water meadow should by its very construction, and its good management, enjoy the full benefits of both the elements of air and water. Practice has proved that there is no better method of doing this, than by keeping water passing over the surface of the land with a brisk current, but not so brisk as to wash away the soil, and yet in sufficient quantity to cover and nourish the roots, but not too much to hide the shoots of the grasses: hence appears the nicety of adjusting the quantity of water; and hence it also appears, that one main drain, to bring the water on the upper side of the mead, and another on the lower side to take it away, will not be adequate to all the purposes of such an accurate regulation. If the space between the upper channel (which may be called *the main feeder*), and the lower one (which may be termed the *main drain*), should therefore be wider than is proper for the good adjustment of the water, that is, so that every part of the space shall have enough water passing over it, and no part too much, then that space must be divided into smaller spaces by intermediate drains, which shall catch and re-distribute the water. These drains are called *catch-drains*, and the ground which can be floated in this way, is called *catch-work* meadows, because the water is caught or collected, and re-distributed by these drains, which in a well formed meadow should never be more than eight or ten yards apart. As the water is brought by the main feeder upon the higher side of

a piece of ground, which slopes toward the main drain, and down which sloping surface the water will run very readily, it does not to persons unacquainted with irrigation at first sight appear necessary to make such a number of intermediate catch-drains; but it is proved by experience, that however regular the slope of ground may appear to the eye, that the water will find a number of irregularities, force itself into gutters or channels, and defeat the purposes of irrigation, in the hollow places by excess, and in the high ones by the want of water. Hence the water, which was scattered over the surface of the first space, being all collected in the catch drain, may by the skill of the floater, be let out upon those parts of the bed below which appear to need the most assistance. Much has been said about the proper situation for water meadows. I am inclined to believe there are only a few soils to which irrigation may not be advantageously applied; my experience has determined, that the wettest land may be greatly improved by it, and also that it is equally beneficial to that which is dry.

Many persons, who are totally ignorant of the practice of irrigation, will be more ready to believe the latter assertion than the former. It may therefore be necessary to explain the reasons why wet land can be as much improved by being floated, as that which before was completely dry. In the construction of all water meadows, particular care must be taken to render them perfectly dry when the business of floating should terminate; and that the season for floating is in the winter, and not the summer, which those

who are unacquainted with the process have too generally supposed. All peat bog is certainly of vegetable origin, and those vegetables are all aquatic. It follows that the same water which has produced the vegetables of the bog, would under proper management upon the surface, produce such grasses, or other vegetables usually grown by the farmer; and I have hitherto had reason to think, that this may be considered as a general rule for determining the situation of any experiments with water. Having succeeded in the attempt to make good water meadows, upon soils which have been deemed unfit for the purpose, and floated them with water that was equally condemned, in point of quality, I am now sufficiently emboldened to recommend the trial of irrigation by machinery, and I entertain the most flattering hopes of success. The grasses produced by the first year's floating of a peat bog, or any wet land, will be much more like what will become the permanent herbage of a water meadow, than the first or second year's crop from a newly-floated piece of dry land. The herbage of the former being previously stored with aqueous plants, is in some degree suited to this new state, whereas herbage of dry land is generally of quite a different nature, and often produces an exceeding great crop of grass the first year, which does not appear the next; for the same water which caused these grasses to grow so very luxuriantly the first year, will totally destroy them in the course of the ensuing winter, and produce an herbage much more congenial to that degree of moisture.—I have had the satisfaction of fully establishing the utility of irrigation in the three counties

of Bedford, Norfolk and Kent, so that sufficient examples of good form and great crops will always be easy of access to those who are desirous of trying similar experiments.

My attempts in two counties out of the three, namely, Bedford and Kent, have been made upon soils which are very different from those of most water meadows in Wiltshire, and the floating them has been done with water which was always considered to be totally unfit for that purpose, even by those who were supposed to be best acquainted with the practice; it is however now fully proved by the accurate experiments of a most able chemist, and also by the extraordinary growth of grasses in Prisley meadow, that such ferruginous waters are not at all prejudicial to vegetation; but on the contrary, very friendly to it, when they are properly applied. These facts, being established beyond all possibility of doubt, afford a much greater scope for the improvements by water, than was ever expected by the most sanguine advocates for irrigation, and enables me to say, with the aid of the numerous observations that I have made in most parts of this kingdom, that there are few districts to which they are not applicable. I will mention some situations to which they appear best adapted and most wanted: the bottom of the chalk hills in Yorkshire is too much like the situation of the best water meadows for any one to doubt of success in irrigation. There is a great deal of poor sandy land, which vegetates very quick in the spring, and copious streams flowing from the foot of the same stratum of chalk which produce the water of all the best irriga-

tion in Wiltshire. I am less acquainted with the chalky districts of Sussex, or the springs that flow from them ; but I have no doubt (from my general knowledge of the lands of that stratum) but there are many situations which would produce good grass, six weeks or two months earlier in the spring than can be obtained by any other means, and which, in the distressing months of March and April, would be extremely useful to the breeders of the valuable race of sheep which that country produces. The vales of Hertfordshire, and the chalky parts of Buckinghamshire, Oxfordshire, Cambridgeshire and Suffolk, are most particularly calculated for the same purposes of floating. Both sides of the chalky part of Berkshire and the edges of the Surrey range must also afford some good springs, which might be conducted to the surface of suitable soils ; and there can be no doubt but there are thousands of sheep kept upon the neighbouring hills, which want the grasses of a water meadow at a time when the turnips are getting old or too often destroyed.



THEIR ADVANTAGES.

*What contrast Wilts betwixt thy hills,
And meads that flow with purling rills ;
The two extremes of nature seen,
Brown barren downs and meadows green ;
'Mid summer's suns and winter's frost,
When all around has verdure lost,
Or snow has capp'd the high-topp'd land,
Sweet plenty smiles at thy command.
For long before thy lambkins play,
The meads the pleasing hues display
Of sprightly gay returning spring.
Such wealth thy streams translucent bring !*

THE advantages of water meadows to those who are acquainted with them, are so evident as to require nothing to be said in their favor. This work is written for the information of those who may not have an opportunity of obtaining correct ideas of a practice which to some appears so simple, I hope therefore to be excused for entering into minute descriptions, that under other circumstances might be deemed needless. Even a small piece of water meadow, which will produce an early crop of spring

feed at the very time of the greatest pressure of scarcity, and when the turnips ought to be off the ground, must be much more valuable to a poor arable farm, than can easily be imagined by any one who has not witnessed the great utility derived from them in many parts of Wiltshire.—What but the water meadows could enable the Wiltshire farmers to bring to market a much greater number of sheep, and that at an earlier season than can be produced from any other county in the kingdom. Yet, however valuable the astonishing flocks of sheep that are annually bred in Wiltshire and Dorsetshire, and from whence the large fairs at Wilton, Weyhill, &c. are supplied, I cannot help thinking that the Wiltshire farmers place too much dependance on their water meadows, because they neglect the growth of turnips, for which some of the arable land in those counties seems to me admirably well calculated. Where the produce of two or three summers will repay all the expences of a water meadow (as is often the case), I should conceive it must answer the farmers purpose full as well to lay out money in floating, as to expend it by any other mode of improvement. How common it is for men to expend 3, 4 or 5*£*. per acre in manure, for the purpose of procuring a crop of wheat, and that after being at the immense trouble and expence of a summer fallow. If the price of labour, loss of time, rent, and taxes for that year be added to the account of seed, sowing, weeding and harvesting, a crop of wheat will be vastly more expensive, in many instances, than even the construction of water meadows, and must be longer before it makes a return, for that crop is not

thrashed out and carried to market until many months have elapsed. The customary credit now given to many millers and factors, makes it full three years before a farmer can expect a return of his expences.

The two years' rent, tythes, taxes, and the repairs, with the expences of putting in and getting out the crop, and the interest of the whole sum during that term, often render a crop of wheat an unprofitable concern. Happily for the community, farmers do not calculate upon all the species of loss and gain so nicely as men in trade or other situations, for if they did they certainly would not grow so large a quantity of wheat. There are undoubtedly many other crops which answer their purpose better, but they have been so accustomed to this sort of grain, and certain parts of their farms have been so long appropriated to it, that they still pursue the same custom, and are but too apt to consider the money that crop is likely to bring them, without once counterbalancing the expences in the debtor side of the account.

Whatever business is liable to great losses, ought sometimes to have a chance of great gains, or it would be impossible to carry on such a hazardous concern. There is nothing in the annals of agriculture which prove that the farmers have lately been playing a winning game. When the minister wants to raise his millions, he looks to trade and commerce, and not to the landed or agricultural interest, which is a decided proof that this is not so beneficial a concern. Still we know that landed property is capable of great improvement, which may be the means of restoring the equilibrium. The advantages of irrigation to the

land-owner are like putting a new estate within the boundaries of the old fences ; and it procures to the occupier the means of perpetuating the most valuable crops from that soil which before was of little or no use. The beneficial result to the landlord and tenant, gives at the same time what must ever be considered desirable—an increase to the public stock of provisions.

Many such experiments as these must of course produce a good effect upon the market, and ultimately tend to the advantage of mankind. The landlords, who raise their rents without any improvement to the land which they let, must get that advance out of the farmers' profits or industry, who rather than suffer by the increased demands of his landlord, puts that advance upon the commodity, and too frequently with an exorbitant addition. It appears therefore that these advances in rent must at last come out of the pockets of the consumer ; and this system of raising the rents, which has hitherto been called improvement, combined with that of injudiciously allowing the tenant, for the purpose of procuring that advance, to break up some lands, and compelling him to lay others down to grass, perhaps very unfit for that purpose, has, I hope, now arrived at the worst.

The land owners will begin to see the difference between real and imaginary improvements, and will consider that their own and the public good is the same ; I trust also I shall very satisfactorily prove to them, their tenants and the community, that all may derive a permanent profit from their barren and unproductive lands which can be improved by draining

and irrigation. A rise in the rent of farms, like the market price of any other commodity, may fall again, but substantial improvements in the soil will always be worth their money; it creates a property for the benefit of the landlord and his heirs for ever, to the tenant for his term, and it affords also a never-failing supply of so much extra food for man.

A spirit of industry and emulation is roused by such laudable examples, labour is increased, the country rendered much more healthy and comfortable to live in, and every person is benefited without any possible injury to another.—Consequently these improvements are worthy the care of the highest orders of society. What can or ought to be a greater gratification to a man of fortune than the pursuit of such a peaceful and exemplary employment of his time and money in his own fields:—He enjoys this unparelled satisfaction and pleasing reflection, that while he is doing good to himself and his family, he is also conferring incalculable benefits on thousands who are in need, and extending those benefits to the latest posterity. If men would reflect on their real situation in life, they would find they are all directly or indirectly dependant upon the soil, and that the care of procuring subsistence for the many, and the property which produces it for the whole, is entrusted to the management of a few, who are the land-owners and occupiers. This is therefore a great charge—a public confidence that ought to be fulfilled with the most conscientious fidelity on their parts, as the trustees of the national granaries, as the providers of food and raiment for the rest of mankind; and though they are not so stiled in

law, yet they are by nature thus denominated. The establishment of the practice of irrigation on an extensive estate is of more consequence than can well be imagined. The discovering of lime and marl in many situations is thought to be a desirable acquisition to landed property; but when all the attendant circumstances are considered, the good effect of water will be found far superior to either. The benefit which is done to land one year by such manures as lime and dung is too often taken away the next, but if tenants could be prevailed upon by any means whatever to pursue a good system of irrigation, such improvements would be rendered permanent, and the fee-simple of many estates easily doubled. The advantages to the landlord, tenant and the community, are all equally great and very different from the casual effects of good management, where large quantities of manure are collected for the purpose of producing a few extraordinary crops; but a proper system of irrigation furnishes the means of keeping the same land in a perpetual state of fertility, and what is still more in its favor, this plenty is drawn from a source that deprives no other land of its benefit. Not so with land improved by manure, particularly in the vicinity of great towns. All extraordinary improvements of lands that are so situated are derived from an extra quantity of the general produce carried there for consumption, consequently those lands which have furnished supplies and are too remote to get manure returned, must be deprived of as much fertility as is added to the other, therefore such improvements cannot be of general utility.—It also frequently happens

that much of the manure of great towns which should be duly returned to the land is wasted in some adjoining river, or washed away by hasty showers of rain, or even when it is taken into the country the farmers who wear the longest purse, or keep the strongest team, are the only persons who have opportunity of benefiting by such local advantages. But the improvements in land by a prudent application of water are of the most extensive nature:—They may be practised in the most remote parts of the country, and in many situations where neither limestone, marl, or manure can be easily obtained, and the full benefits of water may certainly be experienced in the most boggy grounds and rocky heights, to which those of the plough can never be extended. There are also many dreary wastes where no previous preparation is necessary to convert the worst of bog into the very best of water meadow; nor will it be necessary to remove those large stones which in many rocky situations would be insurmountable obstacles to the plough. Irrigation has also the important advantage of perfecting a crop in cold and moist climates, where corn will not ripen, and therefore it is admirably calculated for high and damp districts, which are chiefly appropriated to the rearing of stock; I have indeed heard of water being used to the great benefit of land in Scotland. The excellent grass at some of the waste wears of the Duke of Bridgewater's canal, proves what might be done by irrigation in Lancashire; and the imperfect floating which is done by some of the manufacturers in the neighbourhood of Marsden, is sufficient to shew that irrigation may be most successfully

applied to the improvement of such poor side-lying grounds as the mountains in Yorkshire. It is evident that nothing but method is wanted. This country abounds with water, and the marks of industry are sufficiently apparent in every field to hope for good management in water meadows, whenever the practice shall be properly introduced. It is true that many counties have to boast of attempts at floating, but few that I have seen are worthy the name of water meadows. I have seen some tolerably good at Trentham, between the head of the Marquis of Stafford's pond and the turnpike road. These feeders are made large and grassed over, and there seems to be plenty of water, but when I saw them on the 13th of May, they did not appear by the grass to have had sufficient water or proper management.—I observed a small piece of sharp sloping catch-work to the north of the village of Talk on the Hill, and some meadows by the Trent side, watered from springs running out of the opposite sand hills, which seemed to have a good deal of rough grass, but they laid too flat and wet. Lord Talbot has a water meadow which has been decently made, according to the Gloucestershire method, but when I was there it appeared to have been much neglected: indeed it is scarcely to be expected, that the occupiers of the good pasture land which adjoins this meadow, should be very anxious in the autumn (when they have more grass than they know what to do with) about providing for the wants of the spring. No people are more improvident in this respect than they whom nature has best provided for.—Some meadows at Rudgely are said by the

people of that neighbourhood, to be uncommonly productive and well managed, but they did not appear to me to be so when I passed them two years since. I witnessed another attempt at floating near some large farms in Warwickshire. These, to say nothing of their form, must be defective from a scarcity of water — There are some water meadows near a mill on the north road at Redbourne, in Hertfordshire. Proper attention was not however paid to the draining of the land when they were made, and they are consequently still very wet, and seem to produce only a coarse sort of grass, which is generally much later in the spring and more deficient at hay-making than ought to be upon such a stream and in such a situation. Many other attempts at watering land might be enumerated. The ill success is evidently attributable to improper formation or bad management, and many places might be discovered by an inspection of the grasses which grow in water every winter, where nature has already demonstrated that they might be constructed with advantage. With regard to what improvements might be made by the water-washing great towns, I will mention the city of Norwich as one amongst many instances. Norwich stands chiefly upon such rising ground, that the contents of its drains might be easily collected together, for the purposes of floating the low gardens or meadows to the east and west, and is so well supplied with water that there is generally a vast abundance wasted, which with that portion constantly used by the inhabitants and running down the different sewers, must be of great utility if conveyed to the surface of the meadows: even the

soil of a single street in any heavy shower, would furnish a considerable quantity of desirable manure. If these meadows were drained of their present superfluous moisture, and then floated with water collected from the city, they might be made exceedingly rich and valuable. Meadows thus managed in the vicinity of a large town, which is chiefly surrounded with arable land, where the cattle are principally fed with turnips and the milk impregnated with the unpleasant taste of them, would let to milkmen and others at very high prices. Water meadows near all great places where the luxuries of life always sell extravagantly, might also be most advantageously appropriated to the feeding of early grass lamb.

A well experienced breeder and grazier in the West of England judiciously observed, that a farmer should contrive as much as possible to have things to sell when they will obtain the highest price, and that those who can produce the earliest grass lambs (like those who sell cherries a penny per bunch instead of a penny per pound) have very great advantages. It has long been observed, that water properly applied to the cultivation of natural grasses, has been productive of wonderful crops at an early period. It is a question then of the highest importance, whether upon particular soils and under certain circumstances, it might not produce similar effects upon wheat, vetches, clover, saintfoin, rye-grass, or spinach, cabbage or broccoli, and many other plants of the field and garden. I see no reason why this valuable improvement should be confined to the cultivation of grasses. Many other plants under peculiar circumstances are equally fond

of water, the due management of which constitutes one of the first and fundamental principles of cultivation. The crop of a water meadow never wants weeding, except when the large water dock gets into it; this should be carefully eradicated as soon as it appears, to prevent its spreading, which it will very fast. It is one of the advantages of irrigation that the water produces none but the finest grasses, and most completely destroys every thing else. If the land was dry enough before floating to produce the broad-leaved plantain and its usual companions, the first year's floating will create an extraordinary growth of those plants which will cause their destruction. The flat-leaved broad spreading thistle, which is common to poor pasture and meadow ground, will also grow to a great size the first year that water is applied, but it will be seen no more.—Rushes are completely destroyed by the practice of winter watering (the only time that the water ought to be used); but when people have so mistaken the principles of irrigation as to water in the summer, it has been known to produce them. Thus convinced how and when such noxious plants as rushes are most annoyed and supported, we may furnish hints for their destruction upon lands that can be neither drowned or floated. Water meadows also give us the most correct ideas of the rot in sheep, by limiting the disorder to certain seasons in the year; and what may be said in favour of them on that account is no new theory, but the result of many years' practice and observation in one of the first counties of the kingdom, particularly conspicuous for its extensive breed of sheep.

THEIR FORMATION.

*As hills from mists and clouds supplied,
With water trickling down each side,
To rills and rivulets collected,
Streams on mimic hills directed,
Slide softly o'er each shaven slope
And brighten all our vernal hope;
When meads in verdant hues appear,
Mock the bleak north and crown the youthful year.*

A Water Meadow should be contrived to have a complete command of the water at all times, so that any part of it, or the whole may be made wet or dry at pleasure: this cannot be done if it be not well formed at first. There is often more time spent in the management and alteration of an ill-shaped meadow, than would make a new one.

In a good water meadow we have stated it to be necessary, that the whole should be so contrived as to have a complete command of the water at all times, and upon every part of it, otherwise much water may be wasted by an unequal distribution, and the crop will be of unequal growth; the grass will be injured in some places by a want of water, and in others from its redundancy. If it be observed that an irregular meadow experiences the good effects of water partially, it affords reason to believe, that if the supply be sufficient a proper direction and management would

render the whole equally productive, and the other expences would always be less.

No part of a meadow, either in catch-work or beds, should be so formed as to be floated directly from the main feeder; but all the main feeders should be kept high enough to discharge the water into the small feeders with considerable velocity and through a narrow opening. The motion of water is truly mechanical; it requires a great deal of ingenuity and a perfect knowledge of lines and levels to make it move over the ground in a proper manner. No two pieces of land being exactly alike renders it still more difficult to set out a water meadow; but even if the figure of two pieces be alike, the inequalities of surface will probably vary. Each meadow therefore requires a different design, unless the land-owner makes up his mind to the heavy expence of paring off banks and filling up such hollows as may be necessary to reduce it to some regular method. The construction to be varied according to the nature of the ground. This constitutes the difference between the water meadows of Berkshire and Devonshire. Those of the latter are upon small streams, carried round the sides of the hills, and are chiefly catch-work; those of the former, being near large rivers and boggy ground, are thrown up into ridges to create a brisk motion in the water; and also for the most essential purpose of draining off all superfluous moisture which might be injurious to the grasses when shut up for feeding or mowing. Where there is much floating to be done with a little water, or rather where the great fall of a small stream will admit of its being carried over a vast quantity of

ground and used several times, it is desirable to employ it in such a way, though meadows so irrigated must not be exhibited as perfect models. If it should answer the purpose of a coat of manure upon such an extent of ground, it is all that can be expected, and will amply repay the expence. Losing fall is wasting water. All the drains of a water-meadow require no greater declivity than is necessary to carry the water from the surface, therefore the water ought to be collected and used again at every three feet of the fall, if it be not catch-work. It is sometimes difficult to do this in bed-work meads, but where the upper part of the meadow is catch-work or in level beds, and the lower part not too much elevated, it may be done. By collecting and using the water again in the same piece of ground before it falls into the brook, a set of hatches is saved, and it is not necessary to be very particular about getting the upper part into high ridges, since that part of a meadow which is near the hatches generally becomes the best, and the lower end of the field being often the wettest or most boggy in its original state, requires to be thrown up the highest. If the land is of a dry, absorbent nature before floating, it is not necessary that it should be thrown up into high beds. There are many good meadows in Wiltshire that have little work in them, and some that have neither drain or feeder: but these are extraordinary situations which do not occur in any other county, or they must have suggested the ideas before stated to have been the origin of floating. I have some reason to think, from the natural warmth of peat ground, which keeps it from freezing, that

such land will produce an earlier crop of spring feed than any other. At all events it will first shew the advantages of irrigation, and gravel or sand may be reckoned next to this. The effect of water upon clayey soils does not appear so promising at first, but it seems by what has been done in the lower end of Mr. Rickwood's meadow, near Longleat, that this sort of land may by good management be made equally fertile with the others. The Rev. Mr. Wright says (in his treatise on irrigation) that some of the best meadows in Gloucestershire are upon a clayey sub-stratum. All boggy land is full of aquatic grasses, which may be the reason why it produces such a remarkable crop on the immediate application of the water. If grass land could be ploughed to set two sods leaning against each other, with the grass outward, the roots of the grass would be perfectly dry all winter; the shoots would have the full benefit of the sun, and a great advantage from mutual shelter. This (upon wet land) should be ploughed the way the water runs. If ground ploughed into this form before winter, could be watered toward the spring so as to give it a good soaking, it might be pressed down again to a level surface with a heavy roller. If these narrow ridges were crossed with level trenches at every forty, fifty, or one hundred yards distance, according to the fall of the ground, and those trenches made to communicate with other main trenches, which should run up and down the slope, and supply or discharge the contents of those which are horizontal—such ground might be laid dry or wet at pleasure. And I am inclined to believe, that land so

shaped might be floated all winter with stagnant water to its great benefit, and perhaps in the spring also, if the water be changed at frequent and proper periods; for the water would remain only in the furrows, where there would be little or no vegetation, and the newly loosened soil of the ridges could not fail to absorb moisture, such as will promote the growth of the grass without any danger of putrefaction. The levels must be taken before a piece of ground be ploughed into this shape, and the earth taken out in cutting the cross drains must be used in stopping the furrows on the lower side of them. Perhaps upon wet grounds it would be necessary to re-plough it every autumn, or the strong lands might become too solid to receive the same benefit by it; and it will be necessary to level the ridges every spring, if the ground is mowed, but if summer-fed, it might as well remain in this form as any other. This easy method of getting land up into ridges, which are very narrow, gives to the surface all that inclination which is necessary for drawing off water, and is certainly so far likely to answer the purposes of irrigation. The water is thus under the same command as in any of the best formed meadows, and a much less quantity will be sufficient than under any other system of irrigation. It might perhaps answer the purpose to float young wheat, or any other sort of grain by a similar method. I am inclined to think that flat peaty ground, such as the level fens in Norfolk, which are subject to be covered a few inches deep every winter with stagnant water, would be much benefited by ploughing in this way before the floods commence. Some part of it would thereby be

raised above the water and vegetate quicker in the spring, and the sedgy matter growing up in the furrows, would in a few years raise them to the same level. The cross drains, where on a declivity, would serve to catch and re-distribute the water, and the fall from one to the other must be very little. If this method will not do for irrigation, I expect that four-furrow ridges of turf, with a small feeder upon each, would answer all the purposes of a more expensive system. There is always good grass by the side of the feeder, whether the water runs over it or not; and a meadow of this sort would be nothing but feeders. It requires so little elevation of ridge and fall in the feeders, that the water might be soon used again, therefore a very small quantity would suffice; and if there was a scarcity in the winter the whole discharge might be stopped, and gradually lowered in the spring. This method would answer all the purposes of complete saturation, which seems to be one of the most essential parts of irrigation, and might be applied more or less, according to the time of the year. When the water is put on, I apprehend no grasses would sustain any injury by exclusion from air for a day or two at the first application. If these ridges could be elevated but four or six inches above the furrows, it would give the surface nearly the same slope as the wider ridges of common meadows; perhaps it would be better to begin ploughing the furrows wide at the ridge and very narrow at the furrow, which would leave but narrow spaces for drains. If a piece of turf ground were ploughed in such ridges, according to the common way of turning over the

furrow, if it were set pretty much on edge, I am induced to believe that the grass between would soon cover the whole surface.

Perhaps ridges might be made by beginning the two first furrows more apart than the usual width, thus leaving the width of one furrow between the two first to constitute the channel of the feeder. These ridges must be ploughed up and down with only three or four inches fall between the cross feeders, and the water may be brought into use again at every other set of beds. If the ground requires to be loosened every year, or once in two or three years, it will not be attended with much expence, and there will be no very great inconvenience in mowing ground in this shape, if the sides of the ridges be about a swath wide. I should think that meadows of this sort might be made for 25 or 30s. per aere, floated with less water than catch-work, and have many advantages over it; viz. the water would lie more above the surface, would be more at command, and therefore changed more easily, and it may be pent up better to get a good soaking when scarce. This may be done more effectually in turns, and will run dryer when the water should be taken off. It does not require much skill in the making or management. All the water will be let through nieks, instead of running over a nice level edge, which in the first place is seldom made well, and in the next is difficult to keep in repair. This sort of work would have all the advantages of drains and feeders, whereas the same channels are obliged to serve for both in the common catch-work; it would require but very few or no stops, and

consequently wants but little attendance. It might be practised where there is six or eight inches of fall between the cross-feeder and cross-catch, as the water of each ridge, which should be short, may be let out by a sod with less trouble in the regulation than catch-work. Much of the expences of a water meadow must depend on the number of hatches, and the cheapest and best method of executing them; I have many times turned my thoughts to the improvement of this part of the business. Masonry is always very troublesome and expensive, and more especially in meadows, where the materials must be brought from a great distance, and is often to be laid upon a bad foundation under water: wood work is also subject to much leakage and liable to decay, where it is alternately wet and dry. A good penstock sluice or dam, to stop up a stream of water, for the purpose of floating the land, should be so constructed that no water shall escape, with a proper place to discharge the surplus. If this be done by letting it fall over the top, it becomes necessary to sheet the bottom of the hatches with timber or stone, and even a small stream which has to fall a considerable height, will soon undermine the foundation of the hatches, unless much pains be taken to secure them. I should therefore prefer damming the stream with a pipe laid underneath, to be plugged up with another pipe, which should reach to the top of the water, and serve as a wear to discharge the surplus through the same pipe, which will carry away the whole when this hollow plug is drawn. The top of the hollow plug should be hooped, and the bottom fastened by three or four

chains of equal length, which will admit of its being drawn and replaced without difficulty, and prevent its being taken away

If the trunk through the bank or dam is laid sloping, it will carry all the water of a small stream, save a great expence in the hatches, and make the stoppage of the water much more complete and manageable. If a meadow can be floated from the water which comes from an under-ground drain, and it be at all desirable to return that water back into the drain again, it will be best to cut open the drain, and lay a pipe into it four feet long, with another pipe affixed to the upper side of it, long enough to reach to the surface of the ground intended to be floated. A tube of this sort may be easily fixed in the drain, and well stopped round, so that no water shall escape, with an opening on the upper side for the water to rise in the tube which the plug goes through. The plug must be cut off level with the top of the tube, and the whole may be covered with a flat stone.

It is evident that a tube of this sort will cause the water to rise to the surface when the plug is in, or let the water pass along the drain in its usual course when it is out.

Where the main feeders of a water mead are not more than three or three feet and a half wide, and are subject to no great inundations or hasty floods, which descend with considerable force, it may not be necessary to make any contraction in the stream, in order to regulate the height of the water, nor to have any expensive rollers or racks attached to the hatches. While the head of water can never exceed three feet,

nor the width of the feeders, there can be no difficulty of drawing them if made in the following manner: If the width of the main feeder be not contracted, the water which will rush through on drawing the hatch will have less power to fret away the sides and bottom of the channel, than when it falls with much more rapidity on a sill or through a narrow opening. If the sill is laid in something deeper than the bottom of the channel, I should think it better, as the sediment would then lodge on the upper side, which would tend to make it more water-tight at bottom.

All drains or channels for carrying the water on or off the land, in that constant course and regular quantity which practice proves to be necessary, have two very different uses, and they have been called by two different names. It will be recollected that those which bring the water into the meadow and distribute it along the ridges, have been denominated *feeders*, and those which collect it in the furrows or bottom of the slopes, and carry it into the larger ones, which lead into the old channel, are called *drains*. The first sort continually bring a supply of water to make the slopes wet, and the other sort carrying the water away, prevent the meadow from getting too wet during the time of floating, serve to drain it till dry when that operation is over, and to remove any superfluous moisture which may leak from the soil or fall from the clouds. It is common in some counties to call the feeders by different names—as carriages, gutters, &c. &c. which rather confound than explain their uses; and these names being merely provincial, there can be no harm in deviating from terms of such limited sense. Drains

or channels for the water, whether great or small, have but two distinct uses; I shall therefore for the sake of perspicuity, call all that bring the water on by the accustomed name of feeders, and all those that take it off by the appropriate name of drains, denominating those large ones which convey the water to the meadow, and along the main ridge to supply the other, by the name of *main feeders*; and the ramifications which run along each ridge and distribute the water down the sides, by the name of *floating feeders*. The first operation of floating begins, or ought to begin, at the edges of these feeders; the main feeders being nothing but channels or roads along which the water must pass, from the places where it can be found to the places where it is to have its effect. The place of its use lies between the floating feeder and the foot of the slope or drains, which are made in every furrow for the purpose of catching the water; I shall therefore call these by the name of *catch drains*, and those which collect the contents of each of these drains, being larger and conveying more water, by the name of *main drains*. Thus every drain which is made use of in a water meadow may be easily explained by the name of *main feeder*, *floating feeder*, *main drain* and *catch drain*.

All floating may be done without building hatches in great rivers, which are often attended with heavy expences and many inconveniences. If the proprietor has the land far enough up the river, nothing more is necessary than to go thither and cut a channel out of it, which shall be deeper than the bottom of the stream. The water which will be taken out in this new channel,

may be dammed up by hatches in it at any place most convenient for getting it out upon the surface.—To turn it into its old course down the river, nothing more is necessary than a hatch at the upper end of the feeder. Feeders constructed in this way will be extremely serviceable in time of floods, for by drawing both the hatches an entire new channel will be opened, which is generally much straighter than the old one. To contrive the shortest possible way to get the water upon the ground, it is very evident that an obtuse angle is best calculated for that purpose; it shortens the lengths of the feeders, facilitates the motion of the water, increases the velocity, and consequently preserves that natural warmth or motion which keeps it from freezing in the winter or stagnating in the summer. It also prevents the accumulation of scum, or whatever floats upon the surface, and enables the floater to distribute the water much more equally on every part of the work than if it went in a more circuitous course. The wind has less power to retard the motion of the surface, and the sediment which should go out upon the beds is less liable to lodge in the bottom of the feeders, and consequently the feeders will be cleared out at much less trouble and expence, especially if there be proper plugs or small hatches to draw up for the purpose of sending a stream of water through them, which has been done in the meadows at Prisleys farm, near Woburn. It may appear to many that these hatches are too expensive or unnecessary, but practice proves that the first expence is the best, and that once well done is done for ever.—Inclined planes are absolutely neces-

sary for the purposes of irrigation. To form these between straight and parallel lines, it is necessary to dig away land where it is too high and move it to those places where it is too low, to make such an uniformity of surface. The new made ground will of course settle in hollows proportioned to the depth of the loose matter which has been recently put together, but this settlement will not take place until the new soil has been completely soaked and dried again; therefore these defects cannot be remedied before the second or third year of watering; it will then require more skill to manage a water meadow for the three or four first years, than it can at any time afterwards.

The benefit of these experiments depends so much upon the good management and patient perseverance of those who undertake them, that I do not wonder irrigation has so often proved unsuccessful. However simple the construction of a water meadow may appear to be on a superficial view, those who enter minutely into the concern will find it much more difficult than is commonly imagined. It is no easy task to give an irregular surface that regular yet various figure which shall be fit for the overflowing of water. It is very necessary for the operator to have just ideas of levels, lines and angles; a knowledge of superficial forms will not be sufficient. Accurate notions of solid geometry (obtained from theory or practice) are absolutely necessary to put such a surface into the form proper for the reception of water, without the trouble and expence of doing much of the work twice over.

Amongst my numerous observations and experiments

made in the art of irrigation, it appears that loosening the soil tends very materially to the destruction of rushes and other bad herbage of a bog, and as highly promotes that most desirable change to the best of grasses; and I have also observed, that merely moving the soil and laying the sod on again, will make a great improvement in pasture land; this has been rendered very conspicuous on many parts of the canal near Bath, which was under my superintendence for six years, but most remarkably so in a piece of clayey and stony ground, which was levelled by James Stephens, Esq. in his park at Camerton, on whose estates I first put in practice my ideas of draining derived from a knowledge of the strata.

Draining is a most essential part of the art of irrigation, but it must not be done with covered or hollow drains, for such would swallow up much of the water which should be kept upon the surface; and hence the necessity of taking up all Mr. Elkington's hollow drains, which had been made in those parts of the Prisley bog that I converted into water meadows; and hence it also appears necessary for the designer of plans of irrigation to be fully master of the art of draining, which cannot be well understood but by a knowledge of the strata.

From what I have seen of the method of forming the beds of water meads in Wiltshire, it must be a very troublesome and expensive process. The loose earth of the beds being constantly kept wet during the time they are making, trodden, and mixed together like a puddle, it is impossible to form them with so little labour as when the workmen know, by

regular lines and stakes put in by the spirit level, where to place every spade full of earth.—By the Wiltshire method, one man must also be constantly working in water-proof boots, to tread the earth and continue mixing it with the water like a man in a *puddle-gutter*, which every one acquainted with canal and pond making, knows is very hard work and but slowly performed.

Perhaps it may be said that meadows formed by treading and working the earth together may be much firmer and less liable to settle—this must be allowed, and also that it is very desirable to prevent any settlement in the loose earth which may destroy the regularity of the beds, but on the other hand I cannot conceive how the solidity beneath the soil can be any way serviceable; but many instances which have occurred in the course of my practice, induce me to think the contrary. Indeed I am fully persuaded that the matter of a peat bog, formed into ridges for the purpose of irrigation, cannot be too loosely put together, for the larger the lumps the greater the interstices; the subsoil will be so much the more absorbent, and consequently dry the quicker when the water is taken off. I have also observed that those parts of a new-formed meadow, where there was the most loosened soil, had always the best and earliest grass, though the unmoved part was covered with pieces of the same turf or flag, and floated with the same water and for the same time.—I have therefore, in most of my late formed meadows, avoided all smoothness in the subsoil which is to receive the sod, and instead of shaving off protuberances with a breast plough or a sharp

spade, we now dig out the spare parts and leave a rough or loosened regular surface, on which it is observed that the grass of new-formed ground will grow the best. These observations are not only applicable to earth removed for making water meadows, but to the forming of lawns and pleasure grounds.

It may perhaps be difficult to account for the great variation in the grass occasioned by the difference between loosened and unloosened earth for the sward to lie on. This difference continues to be strikingly apparent in all the ridges which are so formed in the Prisleigh water meadow, but the good grasses are annually getting from the loosened part of the ridges on that part from whence the earth was removed and the turf relaid on the solid. It may probably be concluded by some, that by shifting the earth from the furrows to make the ridges, the accumulation of the best soil in the ridges may occasion this difference; but in the case of peat bogs there is little or no soil, and every part of peat to a great depth is stored with the seeds which nature has thus curiously preserved, probably for an immense number of years, in a state fit for vegetation.

Few people unacquainted with the art of irrigation, and the regularity of form which the nice adjustment of water requires, have any idea of the great expence of new modelling the whole surface of a field. I was once shewn a piece of water mead, only four acres, made by one of the Duke of Somerset's tenants out of a piece of common or rough land, between Warminster and Salisbury, which cost 160£. and I was further informed that it had well answered his purpose. As

this meadow was formed before the great rise in the wages of labour, we may fairly conclude that it would now have cost 60£. per acre. Indeed I have been informed by persons who reside in Wiltshire, that such a sum has been often expended before their water meadows can be called complete; for most of these works, since the time of Farmer Baverstock, have been conducted by ignorant workmen, occasioning such works to be done and undone several times; those alterations are so seldom brought to account that many scarce know what they cost.



THEIR MANAGEMENT.

*By art and nature well combin'd,
With floods in proper bounds confin'd,
On flow'ry grass in water'd mead,
The bleating ewes and lambs we feed
On Avon's banks or smallest rills—
Slow winding thence to lofty hills
The shepherd drives his flocks to fold,
From hunger freed and piercing cold;
While on the dry and arid plain
Some scarce a single blade obtain.*

THE adjustment of water floating over land for the purpose of improving herbage, is a very nice operation: it requires a considerable knowledge of levels, and also of the vegetation of grasses, and ought never to be entrusted to an ignorant and unskilful manager. If the stream be small, it is seldom well managed, and if it be large, there is generally much water wasted. Small streams are certainly much more at command than larger; but if the floater, as is too frequently the case with a young practitioner, endeavours to cover too much ground at a time, he may give one part too much water and another too little; for the alteration

of the apertures, generally done with the foot or the spade, will be clumsily performed. The turfs put in to contract the passage of the water, or those taken out to enlarge it, not being capable of that nice alteration which is necessary for the adjustment of a small quantity of water, it will be better to confine the whole on a small space of ground. If the meadow be divided into different districts, and those districts floated with the whole, taken in turns, the water will be much more easily managed, and produce more grass than when divided. Perhaps the best rules for the general management of water on the meadows for the floater, who has the care of it, are to follow the stream when he has drawn the hatches, and observe how it flows into each of the floating feeders; and that no part of the land may be omitted, I should recommend him to begin with the first of the floating feeders, which branch out of the main feeder, and adjust the water upon that; then proceed to the adjustment of it upon the second, and then to the third, and progressively to the last, until the water flows freely over the edges of each floating feeder. After the water is thus sized at the edges of all the floating feeders, it will be necessary to take a general survey of the state of moisture upon the sides of each bed, to see if they be equally supplied. Any defects discovered must be remedied by altering the apertures on the sides of the main feeder, and this operation requires to be done with more skill than is commonly imagined, especially in meadows which are ill supplied with water, or in such as have been wisely constructed, to make the greatest possible use of it. The beds which have too much

water, should have the quantity reduced by properly contracting their apertures, and suffering them to remain till the water in the feeder has risen to the level, which will be the consequence of this alteration; for it is highly probable, that reducing the quantity upon these beds may add sufficiency to those which before appeared to want it. This cannot be ascertained till the water in the feeder has time to find its level along the whole length. - Nothing further therefore should be done to the water till the effect of the last alteration is clearly ascertained. But there is one rule which may be relied on—that a water meadow, like a garden, will be good for little except it be well attended to and regularly supplied at proper seasons.

I have observed, that the greatest errors committed by those who are unacquainted with the best mode of management, generally occur in the spring and autumn. The after grass is seldom fed off time enough in the autumn to get the works cleared ready to receive the first floods, or gush of the springs; for it does not signify whether it proceeds from a foul stream or clear spring, the effect of early winter watering is always the same, and commonly admitted; therefore if early grass be an object of importance, I should advise the strictest attention to the management of the water at that season. But it must be observed, that many of the best water meadows about Longleat, and in other parts of Wiltshire, are situated at the bottom of high ground, where the springs first begin to break from a sandy soil, which keep the land sufficiently moist to set the aqueous grasses growing at the proper season. I apprehend that meadows so circumstanced

are not liable to much injury from a want of water in the autumn: the crop of grass may not be so great, or early in the spring, as by the aid of a prior application of water. The natural moisture of such springy ground about Longleat, may be sufficient to keep the aqueous plants growing at all seasons of the year, and thereby prevent a change in the herbage to that which upon dryer soils it is naturally inclined to return. This I conceive to be the reason why such meadows do not feel the same inconvenience from a want of water, as those meadows which are situate on a dry gravelly bottom. I presume that all dry and sound upland meadow or pasture, which has been converted into water meadow, in counties where the art of irrigation is not well known, and the stream of water not very abundant or regular, is liable to much more injury from improper management than the moist meadows before described. The general operations of nature being constant and regular, every imitation of them (like watering land) to procure an earlier or greater than common crop of those vegetables which cover its surface, should also be regular; for plants must have their food, at stated seasons, as well as animals; but this cannot be the case with the grass of a meadow, where the water is irregularly applied or inadequate to the purpose. Water plentifully supplied in one season, and very scantily or not at all in another, must one year produce a forced vegetation of upland grasses, and the next a stunted growth of aqueous ones. Now it is evident in either case, that disease must be the consequence, and this — may probably be the reason why water-meadow hay

has been sometimes complained of. Those who live in the vicinity of such lands would do well to make accurate observations on the quality of the hay, in seasons when the meads are totally deprived of water; I am inclined to think it will be much worse than when regularly floated. If this be the case we need not wonder why so many attempts at irrigation have proved ineffectual, for this is the sort of land generally deemed the most proper for floating by those who are unacquainted with the practice; whereas it is proved by experience, that some wet lands have produced as good, or perhaps better water meadows, than are to be found upon the dry soils; but this observation does not extend to all wet land, for I have seen it tried upon a large scale, near Bath, where the natural moisture of the soil or substrata was certainly the cause of its failure. Whether the heat of water be or be not the cause of this extraordinary vegetation of grasses in a water meadow, it may be difficult to determine. There are many instances in which heat and moisture are known to produce the most early vegetation, as is found by the artificial heat of a hot-house. The natural warmth of wood, hedges, and leaves, are also noted for the first signs of returning spring; and the shelter of fallen timber, faggots, and straw scattered on the surface, will have the same effect. Spreading long straw manure on pasture lands in the autumn, in a great measure becomes very beneficial from the shelter it affords. The Earl of Thanet has adopted this practice with great success on some of his clay lands round Hothfield hall. Grasses so procured for early spring feed

I should consider next in value to those of a water mead. Much has been said about the good and bad qualities of water used in floating land; but irrigation, like many other operations of nature, is but ill understood, and from what I have seen of the practice in different parts of the kingdom, it has been only partially tried, and I am fully persuaded that its ill success is owing to bad formation and improper management, rather than to any uncongenial qualities of that fluid. Many will have water meadows made where there is not sufficient water, some will not incur the necessary expence of proper form, even where the situation is good and water adequate, and others have employed persons not qualified for the undertaking. The most general defect of crop arises from a want of water and timely application: great quantities are requisite for a long period in the severe winter months, for what is commonly called a good soaking is far from being sufficient to answer the purposes of irrigation. The water, instead of moistening the ground like a shower of rain, as many unacquainted with floating have supposed, must continue running over the surface all winter, except for a few fine days, to give air and strength to the grass in the places where the water may be too deep and move but slowly over it. But if every part of a water meadow is reduced to regular planes of considerable descent, for the water to move over freely and in sufficient quantity, without guttering, I believe it would be difficult to give that land too much water until the weather begins to be very warm. Observation and experience are therefore the best guides to our conduct upon these occa-

sions, and the artificial method of floating land is nothing more than a good imitation of what nature exhibits in the ditches and rivulets of almost every district in the kingdom.

If men would often revert to this first mistress of arts and agriculture, they would seldom err. The good effects of irrigation are manifest in every country, where casual springs break out upon the surface in the winter. Great quantities of grass are usually the consequence of such overflowings, and where there is a declivity, those places always look the best in the spring.—These natural floodings prove what little art is necessary to the management of water in the winter, where it can be had in sufficient quantity, and contrived to move on and off freely, and that instead of floating for a few days only, which is too frequently done, it would be better to be dry for a few days only, for by those natural overflowings it does not appear absolutely necessary to have it off during the whole of the unproductive months of winter. In all new experiments erroneous principles are easily propagated, and I believe many who have tried to improve by irrigation, have acquired bad habits of sparing the water from a wrong conception of rules, which do not apply to one half of the meadows in the kingdom, and would not be applicable to any if regularly formed. A want of proper elevation and sufficient work in many water meadows in Wiltshire and Gloucestershire occasions a considerable portion of those meadows to be saturated with water before the other parts are properly soaked, consequently many rules for the management of water meadows are only applicable to meads of bad forma-

tion, and these being indiscriminately applied, have been productive of much injury to irrigation. Let any person attentively examine every part of his water meadow, or any other ground water has run over for a considerable time, and he will perceive the best grasses where water has flowed the fastest and in greatest quantity, especially if the ground be perfectly dry at other times, and lies on a proper slope. The Wiltshire floaters say they always wish to produce a root and a shoot before Christmas, thus, by a timely application of water to the drooping powers of nature, a young shoot of grass is obtained before the vegetation of that year ceases, which grass, like early wheat sown in autumn, begins to vegetate much earlier than any other in the spring. It is also remarkable that such grass will bear exposure to the frost much better, for that turns it blue, as it does the wheats; but if the water is applied, when the frost goes away, the grass sustains no injury, but is thought to be made firmer and improved by it, and in a few days it recovers its colour, and displays the most pleasing appearance of spring, and that not unfrequently where the surrounding lands bear not the least marks of renewed vegetation, or are even covered with snow. By applying the water at a proper season in the autumn, that is before the powers of vegetation have ceased to operate, those powers may be extended much beyond the usual period of growth in other grasses. Some have imagined this effect is produced by the natural warmth of the water, giving to the grasses the temperature they enjoy in the spring—but whatever be the cause, it is certain if this oppor-

tunity be missed, and the annual grasses are suffered to die, we must wait the return of the seasons before much can be done by floating. Modern discoveries have taught us, suspended animation may be recovered, to prevent untimely death; but when the frame is worn out by age, all our efforts cease; and why may we not, therefore, produce a similar effect upon vegetables. Mr. Davis, of Longleat, has properly observed, that there must be a winter, or sort of inter-regnum, between the vegetation of one year and another; and adds, the business of the farmer is to contrive, as far as art can do, to supply the defects of one crop of plants by the introduction of another which will vegetate at a different season. Winter tares and rye may shoot early in the spring, and turnips, cabbages and ruta бага (the Swedish turnip) furnish food for the middle of winter; but two out of three are subject to much injury by frost, and the other in some situations is rather uncertain, and always long on the ground, consequently there is nothing in which we can place so much reliance as the early crop of grass. This may be produced by a proper application of water in the winter, for an irrigated meadow should never look brown, or lose its verdure at any period, except immediately after the crop is taken off; or in other words, the land should be floated in the autumn early enough to prevent the frost from taking that effect upon vegetation which causes this brownness of the pastures; such change in their colour being occasioned by a dead end to every blade of grass. Perhaps it may be a good rule to float water meads when the leaves of the elm or other

tender trees first turn colour and fall off. There cannot be a surer sign of declining vegetation than such a change in the appearance of foliage, and as this takes place much earlier in some parts of the country than others; this rule for ascertaining the time to begin floating will be properly adapted to all our variations of soil and climate. Every body knows that our atmosphere is subject to such extreme degrees of heat and cold at those seasons, which are of the utmost consequence to the perfection of an early crop of grass, that we cannot fix upon a precise time to begin or finish with this fertilizing fluid; and it will ever be found most advisable to consult the calendar of nature. Those experimental agriculturists who wish to reduce the practice of irrigation to a still greater degree of certainty, would do well to measure the degrees of heat in the soil and atmosphere, when the water is applied and continues to be upon the meadows. A correct diary of such management, with the temperature of the water and its apparent effect upon vegetation, combined with the state of the weather, would be a very desirable acquisition to the science of irrigation, and might be the means of establishing some general rules for regulating the water on a meadow by the degrees of the thermometer, which would be similar to the variations made in the artificial heat of a hot-house. There are portable thermometers not bigger than a pencil, or flat like a spectacle case, which are sufficiently accurate; and every water meadow ought to be formed to admit all the variations which the floater could wish, or the state of the grasses, soil and seasons require. Mr. Davis's ideas of the heat of water ap-

plied to the purposes of irrigation, having been communicated to me some years since, I have embraced many opportunities of trying its temperature in distant parts of the country.—However authors on irrigation may differ on the same subject, I believe all experimentalists agree, that early winter watering is necessary to produce early vegetation in the spring. In what way this operates is very immaterial to the agriculturist, whether it proceeds from the cream or sediment of the first caught water, or the natural warmth of a pellucid spring. For it is evident by the practices in Wiltshire and Gloucestershire, that they both produce the same effect, and I am induced to think that any judicious observer of the meadows of these counties in the months of February, March and April, will give a decided preference to the clean water crops. I have made this distinction between the two parties who have espoused the cause of water meadows, and find on a candid examination their experience has proved them both right, with regard to the operation of water, however they may differ in their opinion of causes. With respect to the management of water meadows, it will be difficult to lay down such general rules as may be applicable to all soils and situations.

It has been observed, that the quality of the hay cut from water meadows has been sometimes complained of. It may be difficult to account for this, when it is known that water meadows are famed for producing the most abundant growth of those grasses which are allowed to constitute the principal parts of the richest pastures and hay of the best quality. At any rate it cannot be said that water-meadow hay is

generally bad. It has been before suggested that this hay may probably become bad in some seasons from an inadequate or irregular supply of water, and even on a meadow, which with proper management might have produced good hay. Every one acquainted with the process of making hay from the herbage, which is most famed for its excellence, knows how much the good or bad quality of it depends on management. Those farmers who are so covetous of a crop as to let the grasses stand till they are over ripe, or will not take proper pains to part it well from the swath, and turn it often afterwards, will not obtain good hay from any land. And I strongly suspect, if there is any real cause to complain of water-meadow hay, it arises from a superabundant quantity of overgrown grass, or some neglect in the making. The grasses of a good water meadow generally ripen so much before the usual time of beginning hay-making, that but few farmers think of cutting them sufficiently early in the season. It has been justly observed, that the best hay in the kingdom is made in the vicinity of London. This I do not apprehend to arise from the superior quality or fertility of the soil, for I know many poor pastures and meadows within twenty miles of London; but I conceive that superiority is obtained by cutting it early in the season, and a better method of making. If meadow grass is not well separated so soon as it is cut, it is never done afterwards: one part of the crop must consequently in hot weather become dry and brown, while the inside of the locks or unseparated parts remain green, which will produce an unequal fermentation in the

stack.—Much of the art of making hay seems to depend on a proper preparation for that process. Hay, like beer, appears to derive much of its excellence from a due proportion of fermentation. A proper degree of heating in the stack likewise contributes much to preserve that good quality for many years; for it is observed, that hay well made and properly put together, will keep much better than that which is over-dried and lies hollow, which generally becomes mouldy and dusty.

In all arable districts like Norfolk, the farmers must naturally be unacquainted with the art of making meadow hay, more especially that off a water mead, which is still more difficult, for the art of making good clover hay seems to consist in getting it well dried, without moving it so much as to shake off the leaves; but in making hay from the herbage of a water mead, it will be impossible to injure it in this way, or to make good hay without shaking it to pieces immediately after the scythe.—All the hay cut from the Wiltshire water meads is constantly carried off the ground for the benefit of other lands; and this practice has been continued with some meadows for ages, without any injury; nor is their extraordinary fertility supported by any manure but that which arises from the water, as the sheep depastured thereon in the spring are never suffered to lie down, or drop their dung or urine, if it can be avoided. The man or boy who attends them while feeding, immediately drives them to the fold or arable land when they are full and seem disposed to lie down. Thus are the sheep truly employed as dung

carts, to transport the manure arising from the crops of the water meadows to the arable land.

In those great districts of water meads, which in Wiltshire are watered by the common consent of many different proprietors and occupiers of land, the operation of floating must begin and end at certain fixed periods, which it is necessary for every one to know and regularly adhere to, not only to produce a crop of grass, but for the procreation of those animals that eat the grass; consequently as every farmer knows at what time he shall have grass for his sheep, he so manages his breeding flock, that the lambs may be strong enough at the usual time of feeding to go with the ewes, to take their food in the meadows and return to the fold for lodging.

The time to commence feeding upon those large streams is generally about the 25th of March; therefore if the winter be very mild and favorable for the growth of grass, it sometimes gets to such height as many farmers, unaccustomed to the herbage, might think to be much too coarse and luxuriant for sheep, and even too high to be fed off with cattle. So great was the luxuriance of grass in the water meads of Wiltshire two years' since, occasioned by the mild growing weather immediately after the commencement of floating, that some farmers laid their meadows dry, and fed it off in the end of November and December, and by floating again, obtained a crop of feed in the spring before the usual period. Many who did not adopt this method, lamented their grass was too high even in the month of February, and it was then not uncommon to see it in the water meads nine

inches high, laid on the ground and white at the bottom, before the lambs were strong enough to go into the meadows. Some apprehended that the long sour grass would be wasted, yet it was astonishing with what avidity the sheep devoured it, and even preferred the parts which were the longest, and rendered white at the bottom from its extreme thickness; this they would gnaw down to the roots. It was remarked by Mr. Davis, that the grass then on Rickwood's mead, was such a crop as at the usual time of cutting it, would have been estimated at 18 cwt. per acre. Many declared they never saw the crop of the water meads so very abundant and early; but on visiting the same meadow, at the particular request of my friend Mr. Davis, on the 10th of March (when it had been feeding more than three weeks), and asking the floater if they ever began to feed it sooner, he replied "he had had the management of the meadow more than thirty years, and never knew it so early but once, when they began feeding it on the 11th day of the first month in the year." I walked over the greatest part of this extraordinary piece of ground with some considerable difficulty, from the thickness and height of grass, and I could discover but one place (to the great credit of the floater) which was worse than another, and that not two rods square; the man soon saw me notice it, and before I could mention the circumstance, told me he knew what I was looking at, and had contrived to do away even such a trifling defect; so this may be truly called a spotless meadow.

The numberless ignorant remarks which I have heard against irrigation, on account of the quality of soil and water, induced me to be rather minute in that part of my enquiries. The water comes partly from the tail of a mill which stands at the upper end of the meadow, and partly from the pond above it, and is consequently very irregular; and these variations require much more skill and extra attendance to make it produce a regular effect.—The sub-soils of the meadow, I was informed, consisted of three different sorts, gravel, sand and clay, but the effect of irrigation had so obliterated all marks in the herbage, by which they are usually distinguished, making one uniform green carpet of grass, that I could perceive no difference: On asking the floater which was the best part, I was informed the shepherd supposed the gravelly, and that he always wished to bring his flock there first. This preference I conjectured to arise rather from the absorbent nature of the sub-soil, than any great variation in the herbage; for a porous hard sub-soil is almost indispensable, if floated land must be made dry for sheep at that early period, when the sun and wind have but little drying effect. Hence appears the necessity of so constructing water meads (as before observed) to render them most absorbent, or of having some naturally absorbent soil floated, to feed first at this very early season: for it is necessary to apprise those unacquainted with water meads, that no land is dryer, when the water is off, than a water meadow—at least all good meadows should be so constructed.

By the management of water meadows in Wiltshire, the water is continued trickling over the surface till

the grass is grown to the height of five or six inches ; and if the weather be cold, nearly to the time of feeding. This is one advantage which meadows, that are floated with clear water, have over those which are floated with water that would make the grasses foul or gritty ; as the practice of floating may be continued longer with clean than foul water.

The meadows floated with clean water have also the advantage of turning it on to soak the grass a few days or a week before mowing. After the hay is taken off, the water (where it can be obtained in the summer) is put on for a few days to cool the ground, and promote the growth of the after-grass. But wherever sheep are depastured upon the after-grass, the Wiltshire farmers seldom think it advisable to use any water after mowing, or very sparingly, as too much watering in the summer may subject their sheep to the rot.—But the long practice of feeding off that part of the produce of water meads, which is the effect of winter watering, is well known to be perfectly free from this deadly disorder.

It must also be considered, that the amazing crops of grass mown from a water meadow shade the ground and keep it so extremely cool, as to promote a most rapid shoot of after-grass, without the necessity of putting on the water.—In most of the Wiltshire bourns many water meads are floated from streams which are perfectly dry all summer ; but where water can be obtained, and cows are fed, it may be well applied to procure grass to keep up their milk at the end of the summer months. I have heard that watering and feeding alternately is practised with great success

in some parts of Berkshire. The after-grass is frequently fed off with cows or horses in some parts of Wiltshire; for where water meadows can be made completely dry, as they all ought when floating ceases, heavy cattle do not injure the works to the degree that some have imagined. The spring feed, except in very few instances, is eaten off with sheep; and previous to hurdling off the crop, all water should be prevented running on the meadows, and drawn out of all the feeders and drains, to render the ground sound and dry to receive them.—The time required for this must depend very much on the absorbent nature of the soil, the slope of the ridges, and state of the weather; four or five days, or a week, will be generally sufficient. Laying the ground dry before feeding also renders the grass firmer and better for the sheep, if it be not deprived of water long enough to check the growth: in that case it may become dead at the bottom, like the grass hereafter described in the account of marshes. Sheep should not be turned into water-meadow grass too early in the morning, but be kept upon the fallows or some sound dry ground near, till the dew is off. But the practice in some parts of Wiltshire of keeping them in the fold till ten or eleven o'clock will not be thought commendable by those who take that laudable pride, which now so generally prevails, in obtaining the best breed of this most useful animal. The early grass of Wiltshire water meadows is commonly preserved for the ewes and lambs, it being seldom that a farmer in that part of the country, where water is scarce, can obtain water-meadow grass for the whole of his flock; and even

the ewes and lambs are fed with it but once a day at the commencement of feeding. The quantity consumed in a day, or rather at each time of feeding, being ascertained by hurdling out a piece in the most convenient place for making a beginning; at the same time hurdling out another such piece, to which the lambs only have access, by means of a hurdle or two made with openings for them to creep through—this is better than suffering them to have the whole range of the meadow, as they might sometimes stroll too far from their dams, and render them unquiet.

Amongst the numerous prejudices against the art of irrigation, those which relate to the quality of water and time of using it, are the most considerable. Many are ready to allow that water would do good on dry land in the hottest of the summer months; and also that the drainage of a farm-yard, or town, or cream or sediment washed from rich arable lands in hasty rains, might do good upon the meadows at any time. But few have any conception how cold and clear water, applied to the ground in the coldest months, can have any beneficial effect on vegetation. Nothing in the art of farming seems more paradoxical, yet nothing in nature can be more plain to those who attentively view her annual productions.

It matters not with what sort of grasses a new made water meadow should be sown, the water invariably producing those which are most congenial to the state of the land and the degrees of moisture. If none whatever were sown, as was the case with the three meadows made out of the bog at Prisley farm, it is proved that the water will produce those which are most

esteemed and destroy all others. But it appearing necessary that something should be sown to hide the many bare parts of the soil occasioned by making a water meadow, common hay-seeds and rye-grass have been tried at Mr. Beck's and other places. The latter answers all the purpose of a temporary covering to the grounds, and for a short time grows very well in these degrees of moisture. We have some instances in Mr. Beck's meadows, where grasses selected from those most common to water meadows have been sown on one part of a bed regularly floated, which have not been in any degree thicker or better than those on the other part where none were sown.

Those who wish for further information on the advantages of water meads and their peculiar grasses, will do well to consult the account of them published by Mr. Davis, in his very sensible report of the state of agriculture in the county of Wilts, or the extract therefrom in the papers of the Bath society. The most accurate botanical description of grasses produced in the extraordinary water meadows of Wiltshire being already published, it will be unnecessary for me to say more on that subject. The grasses of the Prisley water mead, and those at Mr. Beck's at Lexham, being gradually changing to some of the same excellent quality, it appears by these experiments, and the natural state of soil in many places, and the herbage which covers it, that nature constantly varies the grasses according to existing circumstances. It is also clearly proved, that the greatest variations in the herbage of a field may be made without eradicating the existing plants or sowing

the seeds of others, by merely altering the degree of moisture. This might be well illustrated by an accurate plan of the concentric circles which appear round the upright springs or small shaking bogs, which are common to some of the midland counties, with a botanical reference to the plants of each circle, from the barren centre to the good grasses at the circumference.

In the management of water meadows much has been said about using the water several times ; indeed I think much more than the subject deserves, and that this is one amongst the many cases in the art of irrigation which has been sadly mistaken. The failure arising from water thus used being clearly attributable to another cause, which is the natural wetness of the land, for it frequently happens where streams are diverted to irrigate, that the two or three first beds which are floated were dry land, and the last either too flat to have a good drainage, or are injured from the springs issuing from the dry part above. In either case it is evident that a failure must be the consequence, especially in those meadows which are too generally formed without any regard to remedy this defect. Where water has been used a hundred times, if the last land be equally fit to receive it, the effect is equally beneficial ; and I need not quote a stronger proof than the water meadows about Salisbury, which are floated from water frequently used in the different vallies which are united near that city. The good quality of the water meadows about Salisbury, though nearly the last on the stream, are too well known to require any thing to be said in their favor.

LOW MEADS & MARSHES.

*O ye, midst marshes doom'd to dwell,
Speak ye, for ye the best can tell,
The various curse of agues, frogs,
Foul water, and unhealthy fogs,
Where hissing vipers, crawling toads,
Their horrors add to dirty roads;
Ducks, geese, and gulls join notes as harsh,
While ocean roars above the marsh;
Reeds, rushes bending to the breeze,
From pelting storms no sheltering trees;
Where swarms of gnats obscure the skies
Far as the blue horizon lies.*

*Come art and change this hateful scene,
By moving mills make meadows green;
Bid stacks and steeples break the line,
And herds in wonted groups combine;
Plant the bare plain with rising trees,
And spread the sail to catch the breeze.*

THE art of draining was once deemed an object of national importance, and to practise it most effectually and with the greatest success, to combine the advantages derived from it with those of irrigation, is not such an easy task as may be imagined by per-

sons unaccustomed to such works. Indeed Mr. Davis has judiciously observed, "that had these operations been as easily performed as some were inclined to believe, they would have been done before now."—Even the ancient Romans, who excelled in almost every art, have never attempted this; for if such underground drains had then been made, some traces of them must have been discovered by the number of recent excavations for canals and similar works. My method of conducting this business does not depend upon any nostrum which cannot be explained, even in writing, but from my knowledge of the strata is already reduced to a science, substantiated by a number of practical proofs of its utility in different parts of the kingdom; and I hope I may without arrogance, claim the merit of being the *first* who ever attempted to bring it to that state. From these principles I can instruct five hundred drainers, and make them all equally capable of conducting their profession with equal hopes of success. And it is certainly desirable, that an art on which so much of our comfort and subsistence depends should not be confined to the knowledge of a few.

It is also an art like many others, dependant on a knowledge of nature, which requires the utmost skill in the operator, and a pursuit not unworthy of those who are well versed in the arts and sciences. For the most sensible and provident persons will allow, that all expensive and permanent work is worthy of being done well; and especially that which is upon a freehold estate, where the great emoluments expected from its extension to others, may occasion a public

benefit to rise or fall by the good or ill success of the first experiment ; and such impolitic proceedings have hitherto been the means of retarding the improvements to be derived from drainage and irrigation.

The injury done to some of the most prolific soils in the kingdom, by water-mills, is so general, that there is scarce a stream whose contiguous lands have not felt the evils occasioned by them ; and when we consider the neglected state of natural draining in low lands, and the beneficial improvement to be derived from a removal or alteration of mills, or such obstructions to draining as they have caused ; and add to those the other benefits of draining, and the incalculable advantages of a mill-stream when applied to the purpose of irrigation, I hope it will be readily granted, that no land in the kingdom can be more capable of improvement than that which joins the sides of rivers and rivulets ; for property so situated has the means of improvement within itself, and does not, like the poor sandy heaths and commons lately inclosed, require an immense quantity of manure to produce a few crops, which, without great care in the cultivation, may be soon reduced to their former impoverished state. Much as improvements by irrigation may be talked about, and clearly as nature may point to what is necessary, the difficulty of getting the water well managed is astonishing, even after the works of a meadow are so constructed as apparently to render it difficult for even the meanest capacity to err. In situations where, by accidental operations of nature or the casual assistance of art, extraordinary crops of grass have been produced, we

should naturally conclude a man of observation and reflection would endeavour to imitate such examples; but it is truly astonishing how little use some men make of their eyes and understanding, and I have been often ashamed to be compelled to point out to those, who have every day passed over the same ground, things which appear the most self-evident; but it too frequently happens that there is a supineness amongst men employed in agriculture, which makes them contented with trifling benefits, instead of pursuing the system to the utmost bounds of capability. It is often remarked of land improved, "That it is much better than it was before"—"It does very well"—"I am contented"—"Perhaps an attempt to alter may spoil it, therefore I'll e'en let it remain"—"It will serve my time"—"It did very well for my father and grandfather, and why should it not do for me," &c. &c. But these remarks come from men who are determined enemies to improvement, and consider every thing new as an innovation on ancient customs. And there are others too fond of trying every experiment, and who as frequently condemn, without waiting long enough to know the result of their trials. These men are apt to be biased by a number of frivolous contrivances, by which they tease themselves and give those around them a general dislike to every experiment; for the trial of new projects, even those which have the most plausibility; depends much on a well digested plan, but it frequently happens that people will rather expend much money in executing a bad one than pay a skilful adviser for that which is good.

If we take a general view of all the unimproved lands in this island, and consider what parts of them are most capable of being benefited, at the least expence, we shall find them to be low marshes and meadows situated on the confines of rivers.—This is the land where nature has done the most, and art the least to make it good; in fact in too many situations we find the works of art have so far perverted those of nature, as to render them of very little value.

There are clearly two distinct sorts of good marsh land; the one which is most generally considered as the richest feeding ground, has an under soil of ooze, which must have been originally overflowed by the sea, or some large rivers; but by subsequent imbanking and draining rendered dry enough to retain the full benefit of manure from the animals fed thereon, which, added to the natural goodness of the soil, produces the most wonderful fertility. The other sort of rich marsh land is such as still continues to be overflowed by the flood-water of large rivers several times in the winter, and appears to derive its plenteousness from the fertilizing qualities of the water, and might therefore be properly called irrigated marsh.

The soil of some of the best of the latter sort is very thin, and such as under other circumstances makes some of the worst land in the kingdom. These two sorts of marshes are materially different, and clearly derive their fertility from very opposite causes. If the first be called drained or dry marshes, and the latter irrigated marshes, we shall make the proper distinction. In the first case it is necessary to keep the water off the surface, to prevent injury to the soil, and

in the latter it must be kept on to support the growth of its grasses. The herbage of those lands will also prove on examination to be composed of very different grasses, and I believe their effects on cattle to be also different; for it is well known that some pastures will increase the quantity of milk, but have no fattening quality:—Dry marshes will therefore be most calculated for feeding, and those irrigated most profitable to the dairy. The largest part of the dry marshes in England are appropriated to fat neat cattle and sheep; but as the lands irrigated in the summer are unsafe for the latter, and often too soft to bear the tread of the former, they are so commonly mowed that my ideas of them may not be perfectly correct; but if such irrigated marshes are possessed of the quality of fattening animals, I should expect more benefit from them in the spring and in the early part of the summer, than in the latter or autumn. We may see by the different marshes and low meadows that are every winter under water in various districts, how some places thus situated are improved and others injured; hence we ought to learn the management of such overflowings; for irrigation (though a most excellent system) when carried to excess, or defectively performed, produces the worst consequences. There are numerous instances by the sides of rivers, where lands are greatly benefited or much injured, by being flooded from the same water, and for which evident contrast there must be an assignable reason. That the defects of vegetation are not deduced from any difference in the quality of the water is certain, and probably not in the difference of soil. The various effects on vegetation then must

arise from the various quantities of water—its depths—the time it remains, or the velocity with which it passes over the surface.—That there are many instances of extraordinary fertility in low meadows, which are inundated by rivers, where the tides and freshes meet, cannot be doubted ; and some producing such abundant herbage, are upon under soils so totally different from each other, as to induce me to suspect that the meadows have derived their fertility from the quality and quantity of water, and not from either the soil or sub-strata. If these remarkable instances of fertility are produced from such sources, which I am much inclined to believe, this is a species of irrigation which we have not yet endeavoured to imitate. The facts are well known, though I have seen no observations upon them, for I may say there are but few rivers where some such instances can not be found. These are the meadows which are generally called marshes, and sometimes salt marshes, and such as in many districts are famous for fattening cattle at an early period of the spring, when no other grass can be obtained. There appear to be many causes combined to form such meadows. As the width of the valley, or shape of the ground, at that particular part of the river, for it often happens that the flood-way or space which its water overflows may be too narrow to produce meadows of this or any other description ; or a town or village may be situated on that particular part of the river, and occupy the place of such fertility ; but even where the ground may be favorable for the production of such meadows or marshes, much may depend on the quantity, quality, rapidity and

duration of the overflowing water, and the proportions of salt and fresh water of which it is compounded. Though much of the fertility may have been attributed to the apparently rich mud, which many rivers deposit at the place, where the tides and freshes meet, I can enumerate some instances where no such sediment has been deposited, which prove that the vegetative fruitfulness of such meadows is much more dependant on the quality of the water, than the quality or quantity of sediment deposited ; consequently such compound water as generally overflows these fertile marshes, is worthy of a chemical analysis. From such scientific investigation, I should expect to find it very practicable to imitate this species of irrigation, where marshes are below the level of salt and fresh water, and where both can be obtained in sufficient quantities. If the chemists' report on this fertilizing quality of such water should be equal to my expectations, that method of compounding water, for the purposes of irrigation, may be productive of very great and valuable improvements. The quantity of each might be easily regulated by the sluices for its admission, and a chemical test or instrument might ascertain its quality. Observation and experience would soon furnish a guide to the proper time of application. I am convinced, from a knowledge of the marshes in East Norfolk, and other parts of the kingdom, subject to inundations of the ocean and those of great rivers, where a variety of compound water must be formed, that none of these are productive of good, without a seasonable application. The instances of extraordinary good meadows, on such a great variety

of sub-strata, are sufficient to prove that marshes of every description of under soil are capable of much improvement. Salt itself being known to be a most valuable manure, I do not see why, in many cases by the sea side, machinery might not be erected, to throw up sea water for irrigation. The portion of salt water for agricultural uses must be small, and therefore easily obtained for a large proportion of land, and applied at particular seasons in proper quantity, might destroy an astonishing number of small plants and insects, which would be converted into manure. I apprehend this may be one of the ways in which salt water improves land. The moisture which the salt absorbs from the atmosphere, may be another. Putrefaction being known to be one of the greatest sources of manure, and fresh water in the summer months also to engender much animal and vegetable matter, which becomes highly putrescent. Where both sorts of water can be procured for irrigation, it might be well to float the land with fresh water long enough to produce animalculæ, and then with salt water to destroy them. Perhaps some of our old agriculturists may think these hints too theoretical; indeed I am aware that every new idea must be liable to such appellations, but however that may be, I hope every one will allow that the proposed experiments are not complicated or expensive, but such as may be easily tried, and probably enable us to discover the true cause of the extraordinary rich vegetation of overflown meadows, at the meeting of the fresh and salt-water floods. The good effects of water on one part of a marsh may be very

visible, while the ill-effects on the opposite part may be equally conspicuous. Instances might be enumerated on the Waveney and other rivers where the evils arising to vegetation, from a redundancy of water, proceed not only from the floods, but the land springs. The benefits or evils produced by water can never be more clearly depicted than at this time of the year, (April) nor in few places more so than in the vicinity of Norwich and Beccles.

It must be evident to every one who passes over Gillingham dam in the spring, that the overflowings of the river do much good to the adjacent part of the marshes, while the surplus water, from the upland, is equally prejudicial to the opposite side of them. The advantages to the part near this river, like most others, arise from water flowing over the grass, while disadvantages to the other side, as clearly arise from too much water lying under them. The causes of good and bad quality in the marshes being known to proceed from water, we hence can tell how it ought to be applied. It appears, therefore, that the redundant water of one part of the marshes ought to be drawn away from the roots of the grasses; and some of the surplus water from the other, added to their shoots, and that this is an improvement easily effected, no one can doubt who is acquainted with the situation of the marshes and low meadows which are overflowed by a river.—It is therefore certain, that the improvement of low lands and marshes, by the sides of rivers, would be an object of the greatest importance to the owners and occupiers of all the dry lands on each side of the valley, beside the advantages to the proprietors

and occupiers of the marshes. Indeed there is not much land within the vale of the Waveney, or the vallies which communicate with it, particularly in the county of Norfolk, that is worthy the name of meadows. It is true that nature has furnished the owners of these watery districts, with a few specimens of her best productions, which it is hoped the good sense of the proprietors and occupiers will soon endeavour to imitate. The most perfect specimens of good meadows which have come within my observation, are near Ditchingham dam and the lower locks at Shipmeadow mills. It may be said that those near Ditchingham dam were not so fertile by nature, but have been materially assisted by the number of cattle that have been annually fed on them; but the luxuriance of the grasses which grow in the horse-shoe meadow at Ellingham, cannot be attributed to any effort of art. In these two instances we have, therefore, a fair specimen of what has been done by each of those prolific powers; but it will be clearly discovered, by any discerning man, that no art could have accomplished the improvement which has been made in those good meadows near Ditchingham dam, if they had not previously been dry enough to retain the full benefits of the manure which they have received. Hence it is evident, that drainage is the first step towards this most desirable improvement of all low meads and marshes. To accomplish which, without some injury to those interested in the water passing through such vallies, may be difficult.

The locks on the navigations and different mill dams on the rivers, may have formed considerable

obstructions to the natural draining; if these are insurmountable, it may still be the interest of the land-owners to contrive the best means of improving their property without injury to such long established works; consequently the proposed benefits to land near those rivers where mills and locks are fixed, can only extend to the removal of injuries arising from the surplus water of such works, and it might therefore be reasonably presumed, that the proprietors can have no objection to such laudable attempts. Draining lands below the locks and mill dams, where the water of the rivers has to contend with the tide, must be accomplished in a different way; for land that is below such level cannot be drained without sufficient imbankment to keep out the high water, and a sluice through it to let out the inner water when the tide retires; but in situations where there is not sufficient variation between high and low water to admit of draining by a sluice, then we must have recourse to machinery. Large wheels, furnished with scoops to throw up the water, and which are worked by sails like a common windmill, have generally been employed; but I see no reason why in many situations, other powers might not be substituted to advantage: but these requiring to be great, nothing but steam and water can be applied; the first is too often an expensive power, on account of the high price of coals, and the latter is too frequently unattainable where draining by machinery becomes necessary. There is now no natural outfall sufficient to drain the marshes of East Norfolk and Suffolk, estimated at 50,000 acres, nor any reason to

expect that the mouth of Yarmouth haven, or the course of the river Waveney, will be so much improved as to discharge the water from its level of marshes during the return of the tide. If there be no prospect of benefiting the state of these and many similar situations by an improvement of the natural drainage, recourse must then be had to artificial means—imbankment and machinery; and the banks to inclose any portion of such marshes from the general level, to drain it thus, must not only be made high enough to keep out the highest floods that have happened, but also all floods which may occur when the space which the water has to flow over, becomes contracted. If similar imbankments should be made to improve the marshes on both sides of a river, it is evident that the water which spreads over a great width in such contracted space, must then rise considerably higher; and also that any local imbankment of such marshes which contracts the water-way of the floods from the last fall or mills on a river, to its out-fall at sea, must have a tendency to dam up the water on the unimbanked parts above. Thus when one part of a level of marshes is benefited by keeping out the water, the other parts must be proportionally injured by increasing the quantity of it, especially such lands as lie between the imbankments and the source of inundation; and when, by an improvement of any lands above the tide-way, the water which used to lie on them has been more readily discharged, the inundation of lands in the tide-way must be considerable increased. Hence it appears that all lands which are so circumstanced, may be liable to much

inconvenience from the means adopted to improve the lands both above and below. These observations are applicable to the low lands on most rivers, but more particularly to those in the eastern part of Norfolk and Suffolk.

All low marshes, overflowed every winter, like water meadows on which the water has been suffered to lie too deep or long, are liable to much injury in the spring from a scum or mossy crust deposited upon the grasses. If dry weather succeeds the removal of the water from low marshes, as is frequently the case in the spring, the aquatic grasses which have been nourished by the water of the winter, become dead at the bottom, wanting moisture to support their growth; and the scum formed on the diseased part of the plants, rattles under-foot like parchment or a dried skin, which may probably have given rise to the Norfolk name of lamb-skinned grass. Many marshes which I surveyed for an assessment to the sea-breach repairs in East Norfolk, on the 12th of May last, were in this state, and I was informed by one of the most sensible marshmen, that in consequence thereof, those parts would produce no good grass before Midsummer, and even then the cattle will only eat the ends of it, whereas upon the dry banks they will gnaw it down to the ground, and horses will even tare up the roots. In the month of May most of the low places in the marshes, where the water had been of an extraordinary depth, were full of little brown grubs, which are commonly supposed to do much injury to the grass; but I suspect that the depth of the water, and the time it remained on (by producing a diseased crop of grass)

have been the primary causes of the evil. The marshmen also complain of the mischief done by the young rooks scratching off the grass to get at these grubs. But it does not require a moment's reflection to discover by their own observations that both these evils would be most effectually removed, by keeping the marshes dryer all winter, and that the grasses would also be rendered much hardier and better for cattle; but an earlier and greater crop of grass might be obtained by moving the water over the surface by machinery.

Having mentioned floating land by machinery, I think, though the method may be new or unskilfully tried, still it may be practicable.

If land be put in a right form for floating, and supplied with a good stream at proper seasons, I should conceive no difference to arise from the method of getting it on the surface, and I should confidently expect the water thrown up by a drain mill, to produce the same fertility as that which runs from a brook, where all other circumstances are equally favorable; and I am happy in being soon likely to try this experiment on some newly-drained marshes, belonging to a spirited and well-informed agricultural gentleman in East Norfolk.—Such an example in a marshy district of 50,000 acres, may be of the highest importance to many, and its success will lay the foundation of unlimited improvements in low meadows and marshes.

THE PRISLEY BOG.

*While Britain boasts her mighty warrior's fame,
On Adamantine records deeply grav'd,
Here to the shrine of princely, patriot worth
Shall Liberty with tearful eye repair,
And Peace and Science, and her sister Arts,
With Gratitude shall long their loss deplore.*

*Short was his course, for like the wand'ring fires
That with new splendors heav'n's high vault illumine,
And gild dark earth with silvery light, his life
Its mild yet radiant glories shed o'er all.*

*E'en now his patriot spirit breathes again,
And the rich promise of his brilliant hour
Glow's in a brother's breast. O may he live
To spread his blessings o'er our sister isle,
Whose sons shall prove as grateful as her soil!*

IT must be remembered that the drainage of Prisley bog occupied the attention of the public some years since, and was then deemed a proper place to determine the merits of Mr. Elkington's method of draining, which had been represented to the Legislature as an object of national importance. In the year 1795 parliament voted the sum of one thousand pounds' to reward Mr. Elkington, for his discoveries in draining land; and a committee from the board of agriculture, consisting of his Grace the Duke of Bed-

ford, the Duke of Bridgewater, Sir Joseph Banks, Sir John Sinclair, and several other persons of distinction, inspected Mr. Elkington's plan of draining this bog. The main drain was marked out by him in the presence of the committee, with the fullest assurance that the drainage would be accomplished without the aid of any other but a very large sum of money was afterwards expended in cutting several more, which were all laid with brick, but produced so little effect upon the bog, that some part was nearly knee-deep in water when the rushes were mowed off for me to begin the drainage. As it might appear invidious to make all the observations I could on the very bad state of the drains which I took up, and the ill-judged position of them; and some account having appeared in an agricultural magazine, relative to their failure, I shall pass them over without further remark. The incredible increase of the value of the land since I improved it being shewn in this detail, and also in the 4th volume of communications to the board of agriculture, any further comment must be unnecessary, I shall therefore proceed to describe the state of the bog when I was employed to survey it.

There was nothing in the appearance of it at the expiration of eight years' fruitless trial, which would have induced a stranger to think that any drainage of it had ever been attempted. This was the condition of the worst part opposite the farm-house, and the place where the most drains had been made, but some of the firmer parts of the bog above and below would sometimes bear a horse, whose long ac-

customed caution had taught him where to tread, and it had been observed that no herbage would fatten a horse quicker in the spring, or make him poorer in the autumn. It had also been remarked that sheep had always improved upon these moors for a few weeks in the spring.—Now these opposite effects appeared to arise from the water, and were good corroborations of my opinion, that such ground was fit for floating. The natural warmth of the peat-bog, and the springs which bubbled up through it, occasioned a degree of heat and moisture in the winter sufficient to produce early vegetation in the ensuing quarter, while the summer shoot was either stopped by stagnating water, or checked by the more powerful progress of aquatic plants. Such were my ideas on the subject, and these being confirmed by the luxuriant growth of grass, where the water ran briskly in the brook, I had no hesitation in recommending to his Grace the trial of irrigation. At first sight it may appear madness to many, to water that which is too wet already; but where there is a peat bog, with a good stream of water at command, I could venture to recommend this as the best method of draining and making it good. If the matter of a peat bog be investigated, all live peat bogs are composed of vegetable substances, which abound with seeds or roots of many aqueous grasses, such land is consequently fit for irrigation, whenever the degree of moisture can be properly appropriated. But if peat be entirely deprived of all moisture, and left exposed to the summer sun, it is then little better than a barren substance. The plants on the surface being totally deprived of

their former subsistence cease to vegetate, and the vegetable matter (for in this case there is little or no soil) being wholly destitute of the plants and seeds which are suited to dry land, or unfit for their support, the most perfect sterility must be the consequence, until art or nature shall form a thin soil upon the surface of such vegetable substance. The former must be expensive and the latter will require a very long time, consequently it will be most advisable to float or plough a bog immediately after it is drained. It then contains sufficient moisture to support the growth of such grasses as are fit for irrigation, and it will come to a soil (if ploughed up in a damp state) much sooner than if it be permitted to become dryer. It is well known that peat once dried will not readily receive moisture again, and this may serve to account for the uncommon sterility of some peat bogs, which I have seen ploughed up after draining. All the works of Prisley drainage and irrigation having been completed long enough to substantiate the utility of them beyond a possibility of doubt; the extraordinary improvements much talked of, and an account of the produce read before the board of agriculture in May, 1804, I think it a duty incumbent on me to present the public with some account of it myself. I am the more anxious to perform this task, on account of the national loss of its late most noble and illustrious proprietor, and that I may have an opportunity of paying some small tribute of respect to the memory of that truly good and great man. The account of this bog will not only shew the persevering spirit of improvement by which the late

Duke was actuated, but afford ample testimony that the same plans are pursued by his Grace the present Duke, who has fully proved his attachment to agricultural pursuits. Only a small part of this concern was executed (the first water-meadow) by the order of the late Duke ; it is therefore to the judicious discernment of his Grace the present Duke of Bedford, that I am indebted for the honor of accomplishing a drainage which was once deemed worthy even parliamentary reward. The sum which the House of Commons voted to Mr. Elkington, was only for making the land dry ; but doing that alone was far from rendering it good, which was the object of my improvement, and in which I have fortunately justified my own opinion and the expectation of my friends. Some instances might be enumerated where bogs have been very little benefited by draining only, and I shall also mention others, where, by my plan of combining draining with floating, they have been converted into meadow ground of the first quality, and that by the means which were found on the spot, and which were previously even the cause of its sterility. The method of transforming the evil into good, when the quick return and all the advantages of a water meadow are reckoned, must be acknowledged the greatest and most advantageous method of improving boggy land ; and there can be no crop whatever that will give the same annual produce for an unlimited term of years without impoverishing the soil, which may be obtained from a water meadow. The bad grasses, at least for mowing, of the *holcus* genera, were the first product of the bog after irrigation, but

which gradually gave way to valuable sorts of *Poa*, *Alopecurus*, *Festuca*, and other grasses, forming a close herbage. The expence of getting such extraordinary crops is also much less than that of any other land in cultivation.

The three water meadows at Prislej were made from parts of the bog most convenient for getting the water on the surface, not that from the brook alone, but that drained from the upper part of the bog, being employed in floating the pieces of land below. To accomplish this required much contrivance, and some additional hatches and other expences, but the meadows are more completely watered than they could have been from the stream alone, having obtained by the drainage a quantity of water nearly equal to that of the brook, and which I was very anxious to use, being by an ochrey appearance hitherto deemed unfit for floating. As the lower part of the bog would have the most water, and which could be easily diverted from the brook along Mr. Elkington's open drain; and save the expence of a new feeder, I there wished to begin the experiment; I also found sufficient fall to admit of the surface being formed to lay it completely dry; when the water should be off; and except that can be done, irrigation will never succeed. The upper part of the bog had been proposed for the trial of irrigation, but finding the quantity of water not increased in the winter, according to my expectation, was a farther inducement to prefer the lower part. Messrs. Buckley and Crooke, who were with the Duke, coincided in that opinion, and with his Grace, saw the propriety of changing the

situation; and the works were accordingly begun on the lower end in February, 1802, and but few men were employed. To procure an early profit from the improvement, I recommended the additional expence of paring off the turf, and laying it on again, and the sheep were kept in the unpared part during the making the other parts of the meadow. It has been observed, that many of these warm bogs produce much early feed among the rushes in the spring, and which being at that season of a good fattening quality, made me very confident of success. When the Duke, accompanied by Mr. Holland, inspected the works, two beds only were completed, and covered again with the rough rushy turf, and many others in an unfinished state. This was about the beginning of March, and the last time his Grace ever saw the meadow. There was much dry weather in the spring, and great part of the turf or flag pared off, was become dry enough to burn, looked brown, and void of vegetation as a turnpike road, and so light as to require fastening with pegs, to prevent the water employed in floating from washing it away. The masonry of the hatches being incomplete, no water could be applied to any part of the work till the 15th of April, and before the middle of August that which was floated first was mowed twice, notwithstanding the brown barren appearance of the new-laid turf.—Such was the rapid growth occasioned by water that the Duke's steward estimated the first crop, cut from some part of it in June, at 30 cwt. per acre, and the second at a ton. His Grace the Duke of Bedford, the Marquis of Bath, Lord Preston, Mr. Adam, and several other persons

of distinction and great agricultural skill viewed the meadow, and were astonished at the produce and good quality of the grasses. A very considerable part of this land was formed previous to the sheep-shearing in June, 1802, and the grass upon the part which was floated first on the 15th of April was nearly fit to mow.

Mr. William Wyndham, of Dinton Park, near Salisbury, and Mr. Penruddock, who are well acquainted with the water meadows in Wiltshire, went with Mr. Crooke and others at the sheep-shearing and viewed the works; they expressed their astonishment at the rapidity of the improvement, which was more clearly indicated in that unfinished state, than in any other, which Mr. Wyndham said would repay the expence in two years, and which, to the credit of his judgment, is fully confirmed by the account of the crop.

Knowing that I had not only to make a water meadow, but rooted prejudice to contend with, I was determined to render every part of the work as complete as possible, and to put the whole surface in a regular form, which should not require any alteration or more skill in the floater than comes within the capacity of a common labourer. On that account these meadows have been attended with some expences which might have been deemed unnecessary where their form and management is better known. But I have found by experience that the saving of expence in the establishment of new experiments is very often ill-judged economy; my chief aim therefore was to construct the meadows as a PATTERN OF PERFECTION to those who choose to improve similar bogs by the art of irri-

gation. Every feeder or drain which it may be necessary to cross with a waggon or cart, for taking off the hay, is therefore arched with brick, and the foundations being a soft peat are laid with inverted arches, which has made them more expensive than the same number of arches would have been upon sound ground. We must also consider the extra cost of bridges, which are not common in Wiltshire, their crop being taken off by putting hay into the feeders or drains, or by means of temporary bridges over them, of faggots, timber, or hurdles; but considering that these temporary methods in negligent hands might create impediments to drainage and prevent a most essential part of irrigation, I concluded that the first expence was the best and safest. Some may also think that the hatches might have been made in the common way much cheaper—I allow there might have been some saving, but such hatches being used in all the water meadows at Woburn long before I went thither, and being a safe and good plan, I readily adopted it. The meadows are all contrived to float with the least possible wood-work. Some additional expences were incurred by wheeling earth to a great distance, to make the beds of the same level, where it could be accomplished. Earth was also wheeled to the imbankment of many of the head ridges, from a great distance, to give a sufficient elevation in the main feeders to admit of a good fall for the water at every aperture that supplies the ridges. By having a fall at each of the apertures between the main feeder and the floating feeders, the quantity of water upon each bed can be regulated much better than by the

usual way of letting it out through a wide opening. The adoption of this plan became necessary for the proper adjustment of a small stream of water, and also for the simplicity of management. Some narrow openings are also made through the opposite edge of every main feeder, to discharge water enough into a small parallel floating feeder, which distributes it equally upon the wide slope of all the main feeder ridges.

This method of spreading the water is not in common use, and like the narrow openings before described, contributes largely to a better distribution than is common to meadows in general, or in other words the adoption of these contrivances will enable the land owner to save much water which would otherwise be wasted, consequently he can float the same quantity of land much better, or can float more ground with the same water. The edges of all the floating feeders were reduced to a true level from end to end, or from one stop to another; but stops were purposely avoided wherever possible to save the trouble attending them, and also to prevent a possibility of mis-management. The beds were of course made much shorter than in other water meadows, especially those in Gloucestershire, which occasioned more main-feeder ridges than usual, and consequently much more expence in wheeling earth to form them. As the few stops which are necessary upon such short ridges are all fixed, the floating feeders made truly level from end to end, or from one stop to another, the water upon each division of this meadow receives from its form a sort of mechanical motion, and flows into each float-

ing feeder at the same instant with equal velocity and equal quantity, when the stops are adjusted, and will consequently wet or float each ridge alike, if there be no mole-holes or places trod down to rob the floating feeder of that water which ought to flow over every part of its level edges like water running over a gauge or waste wear.

This is the only true principle on which water can be equally distributed. The quantity of water being sometimes insufficient to float the whole of the Prisley meadow at once, it is contrived to be easily divided into three parts, and each of these sub-divided by the use of a common hatch, or piece of board of the shape of either of the main feeders, fixed in them to stop the water out of any part, and force so much the more upon that which is intended to be floated. These contrivances were necessary, not only on account of the great scarcity of water, but also for the purpose of employing all the water upon any one part of the meadow while the grass is feeding off the other; and where the levels will permit, something like this ought to be done in every good water meadow, for it is not merely the elevated surface necessary for floating which constitutes a good water meadow, but the design which is best calculated for the general purposes to which the land, the water, or its produce may be most advantageously applied. The three parts of this meadow, which are regulated by two hatches, are only upon two different levels. The drawing of either of those hatches lays the high part dry and puts the other part afloat; at the same time shutting down either of those hatches will let all the water upon the

remainder of the lower level; if that hatch be kept open, or if both the hatches are shut down, the whole of the water may be employed upon the high level. If there is more water than sufficient to float either of the three parts separately, each of the two regulating hatches may be fixed at such a height as to use the remainder on the upper level, or the high level of the meadow may be made to receive its full quantity of water, and an opening left under one or both of the hatches, to distribute the remainder of the water on either of the parts of the lower level wherever it may be wanted, or the whole of the water may be used upon one of the lower levels by adjusting the hatch so that that part shall have sufficient water, and drawing up the other high enough to discharge the surplus; or if one part is floating and neither of the other pieces want water, any overplus may be turned down the waste ditch which divides the meadow from the upland, by drawing the main hatch high enough to discharge such surplus water under it. The water is capable of all these variations—but there will seldom be any occasion for turning the water to waste, since it may generally be all employed upon the meadow, or a third of it, if the other two parts should be in use. It will be found most advisable to feed only one part of such a meadow at a time; the other two-thirds might then be floating alternately. When that third was fed off, the most forward of the other two might be laid dry for feeding, and the new-fed part floated in its stead. By this plan of feeding one third at a time, and keeping the other two thirds afloat at the same time, either together or separately, accord-

ing to the quantity of water that will be always constantly employed from the first commencement of floating to the termination of the feeding, and floating after it, when the whole may be shut up together for mowing. The spring floating may be continued at intervals, if the water be not foul, till the grass has gained a considerable height, but it must only be put on for a day or two, to cool the ground and keep the grass growing: this management, if it be well conducted, will be of great service in forwarding the crop and increasing the bulk. The ground will also be the cooler and better for it when the crop comes off, consequently it will make the after-grass grow so much the quicker. No time should be lost in putting on the water immediately after the hay can be removed. Whenever one third of the meadow can be cleared the water should be directly put upon that part till it is pretty well soaked, and then upon the other parts in their turn, as soon as they are cleared. Great care should be observed both in feeding and taking off the hay, that it be done with a view to clear that part earliest where the water can be first applied to produce another crop. The water should never run to waste but in the height of summer, when the grass may be high enough to form a thick cover for the ground, and keep it cool and sufficiently moist for the purposes of vegetation without the aid of water, and also at the end of summer or autumn, when (if the meadows are fed with sheep) there may be some danger of rotting them by its application at this time of the year. It will appear to those who are acquainted with the proper management of water meadows in

Wilt's (by the statement which I received from his Grace the Duke of Bedford, and which has been laid before the board of agriculture), that the grass was begun to be fed before it was fit; and from the long time that the sheep were kept upon the ground during the months of February, March and April, there was much of the water wasted which should have hourly been employed at that prolific season. Experience proves that there is no danger of getting the grasses too strong upon the ground at this early season, and that crops which are six or seven inches high, and apparently too rank for a bullock, are fed with the most eagerness by sheep in the spring; and those parts wherein the grass is the thickest and most luxuriant, are always fed the closest and sought after with the greatest avidity. This being contrary to the common habits of all animals which graze upon dry pastures, where they give a decided preference to short and sweet herbage, may lead many persons to think that the grasses of a water mead may be too high and luxuriant for sheep, but practice has proved that such long grass is neither uncongenial or unsavory to them. We also know that the grasses always grow the fastest when they have gained considerable height and strength; they then thicken much at the bottom, and the roots get a greater hold in the ground, and are consequently not so liable to feel the want of water during the time of feeding, and make a much stronger shoot when shut up again and the water restored to them. The greatest crop will also be of the best quality, both in grass and hay, and will always be fed much closer and more even

than in those places where the floating has been in any way deficient. The floater, as he is generally called, or the man who has the superintendence of water meadows, should therefore endeavour to make every part of the crop as uniform as possible, for no meadow can be said to be complete till that is accomplished.

Any judicious observer may easily discover the management of a meadow by the crop upon the ground, whether it be in the spring, summer or autumn; for if the grass appears patchy or of different sorts and colors, there can be no doubt but the water has been partially applied. The different shades of the ground after close feeding and mowing, also shew the parts which have had the most water and where it has been different. Workmen who have been accustomed to the mowing such crops can also tell those parts by the different cut of the grass. Much of the perfection of a water meadow likewise depends upon the care and pride which the floater takes in doing his work well; it would therefore be very advisable not to change these men when it can be avoided, but to keep the water meadows under the care of the same workmen so long as they manage them well, and no one should ever alter the water but he who has the constant care of attending it. Water meadows will never be brought to perfection in any country till the proprietors and managers of them shall take a pride in conducting them properly, and strive to rival each other in excellence. Land owners and agricultural societies should therefore offer premiums for the greatest produce which can be obtained

from a given quantity of a water meadow, and a smaller premium to the floater. This would create emulation, and a spirit of industry and attention to a pursuit which might not otherwise have been thought of. As the crops of water meadows are much more at the command of the farmer, and less subject to blight or drought, or the uncertainty of season, than any other which he cultivates, this would be a fair subject of competition in the skill of the managers, and the premiums should not be determined by the produce of a single crop but by the aggregate of the whole year, including spring-feed, hay and aftermath. These plans, which ought always to be adopted, are mentioned in this detail of the Prisley bog drainage, to shew the method pursued and the correctness of the first ideas of the undertaking.—It should also be perfectly understood, that although the Prisley water meadows may be considered worthy of imitation, still the same expence may not be necessary to convert all bad lands into a productive soil.

It will be remembered that no parts of this work were begun till February, 1802; but in

March, 1803, the meadow was stocked with two hundred and forty sheep three weeks, estimated at 6d. each, £18 making the spring feed worth more than 2l. per acre.

April 16, shut up for hay.

June 23, mowed two tons per acre, at 4l. per ton, £72

Aug. 20, again mowed one ton and an half, at 4l. per ton, £56.

Sept. 16, put on eighty fat sheep for three weeks, at 4d. each, £4.

And then it was fed by lean bullocks, which is not reckoned in the account, producing £16 13s. 8d. per acre.

In the second year, 1804, it even so early as February was stocked with one hundred and sixty-four hog sheep, being more than eighteen per acre for nine weeks, their keep estimated worth 5d. each, making the spring feed worth 3l. 8s. 4d. per acre, £30 15s.

April 26, shut up for mowing.

June 21, began cutting.

There was a larger proportion of the best grasses this year, and the crop was considerably more than the last, and the produce, of course, greater per acre. It was just at this time the account was presented to the board of agriculture, or all the profits would have been particularised, and this meadow has been annually inspected by the first agriculturalists and most skilful irrigators in the kingdom, who agree that it evidently continues to improve. This satisfactory and undeniable proof needs no comment, and shews that the system of draining, combined with irrigation, enables the farmer to keep a larger quantity of stock in the distressing months of March and April, and consequently more the remainder of the year; and it is very evident from the before-mentioned fact, that even the cause of the bog may be successfully employed in destroying it.

This copy of the account of this water meadow at Prisley farm, near Woburn, in Bedfordshire, was read before the board of agriculture, and given to me by his Grace the Duke of Bedford, the 16th of May, 1804, with his Grace's permission to publish it. The whole

of the bog is completely drained ; and the other two water meads become nearly equal in quality to the piece above described, and the unirrigated part now in good cultivation.

Mr. Willis, of Norton St. Philip, in Somersetshire, has a water mead, containing twenty-one acres, by the mill in that parish, and from which he always reckons to make a ton of cheese (from fourteen or fifteen cows), and afterwards to mow three tons of hay per acre. It is generally fed until the first of May ; therefore this quantity of cheese made previous to the grass being shut up, shews how early Mr. W. is enabled to put his cows into that pasture.—At Teffont, in Wiltshire, there are five acres of a water mead, which have maintained 200 couples for a month, and 7 or 8£. per annum have been made of the folding only, but the owner of the land finds some hay. From 25 to 30s. per acre has been given for the feed from Lady-day to the 4th of May, when it has been shut up and very great crops mown off it.—Mr. Baker, of Chittern, in Wiltshire, during the year 1799, gave 25s. per acre for one month's spring feed off a water mead, and the grass was not of a good quality.

Near Lavington, in Wiltshire, 8£. has been paid for the feed of an acre and an half, during the short term of six weeks.—I have heard that Mr. Rickwood's water mead of thirty acres, enables him to maintain 600 breeding ewes in the spring ; that half an acre of grass at that season is capable of supporting 1000 sheep for a day. Some have observed that the hay produced off land floated from the drainage

of a village or farm-yard is of a much better quality than that irrigated from clear water, which experiment has been tried by making tea from both sorts of hay.—I conceive it unnecessary to refer to more instances, except those of the boggy land at Lexham, lately converted into excellent meadows, and for which Mr. Coke obtained the gold medal as before mentioned.

LEXHAM WATER MEADS.

The boggy part was begun forming on the 2d of January, 1804, and no water put on it till the 15th of May following.—The part then floated was about four acres; the remainder of the boggy and about four acres of the gravelly part received the first water on the 28th of May. On the 25th of June the whole nine acres were mowed, and produced about eight tons of hay. The parts of the surface which had not been moved, or those where the herbage was not destroyed or much injured by that operation, was equal to two tons per acre. When the hay was removed, the water was immediately applied for a few days, and then shut up for after-feeding, which commenced on the 16th of July. The stock put on consisted of 120 fatting sheep, which remained there without any other food till the 22d of October. The works were then begun to be cleaned ready for winter watering; and as they proceeded each part was floated, and thus the whole nine acres were completely irrigated by the 2d of November. Until March 6, the meadow was continually watered, except for a few warm days, when it was relieved; but from this time the water being

thought warmer than the atmosphere, the intervals were very few. The water was from this time finally removed for the season, to get the land sufficiently dry to receive the sheep, but the turnips being plentiful the feeding was deferred till the 16th. The nine acres were fed with 126 ewes and their lambs, from that time till the 3d of May. The grass was regularly hurdled off in such quantities as could be daily consumed without waste, in the customary manner of hurdling off turnips: the lambs had free access to the grass at any part, by means of a hurdle with an adjusting aperture that excluded the ewes. This is deemed a good practice, as it assists the growth of the lambs and relieves the ewes. This stock had no other food than what they obtained from the water mead: they were turned on the dry and unfloated part at night in the same field. When the sheep were removed the weather was remarkably cold, with severe frost for a fortnight.—The water was applied every night, but, from the coldness of the season, produced but little effect. It continued cold till the 21st of June, and the grass grew but slowly. The meadow was viewed at the Holkham sheep-shearing by the Duke of Bedford, Sir Joseph Banks, Lord Darnley, and other great personages, and eminent agriculturists who saw it at the same season in the preceding year, and observed the difference occasioned by the coldness of the season, which was generally acknowledged to be later than usual by near three weeks.—It was also observed by Mr. Beck, that the herbage was very different from that of the preceding year.—This change was also noted by many skilful botanists. The

prevailing grass of the first year, particularly on the gravelly part, was nothing but a forced vegetation of the usual herbage of such poor land, amongst which the rough coarse grass, called Yorkshire Grass, was most conspicuous. It was observed that this species of grass was much diminished in the crop of the second year, and now scarce any of it can be found: the change to the best was most evidently conspicuous and discernible at a distance. The prevailing herbage of this year, 1805, was the rough stacked meadow grass; the mowing commenced on the 6th of July, the crop very great, at least two tons per acre. From the prevalence of good grasses, of course the hay was much better.—From the extreme thickness of the grass, great pains were taken to part it well; cows were fed on it in the winter, and it was observed to produce good milk. After mowing, the meadow was floated for a few days as on the preceding year, and on August 5, began feeding it with fat sheep, many of which were killed by Mr. Beck for his own family, and the rest by the neighbouring butchers, and no symptoms of rot were discovered in these or those killed the preceding year;—one of the ewes is still living on the farm. Mr. Beck is endeavoring to ascertain this effect on sheep, by putting in eight lambs, which remain for further observation. During this period other works on the dry and higher part of the field were preparing to receive the casual floods from the adjoining small valley.—The improvement on this part has produced an amazing crop of hay, though from the uncertainty of the water it cannot be deemed a specimen of the most perfect irrigation.

On the 25th of October, 1805, the works were cleaned ready for watering, but the season being dry the stream was remarkably diminished, and only sufficient to float about two and an half acres of the beds in the lower part, which was regularly continued on till the 14th of December, when the melting of the snow produced water sufficient to float the whole. On the 2d of January, 1806, it was observed that the grass, from the abundance of water and during the time it was covered with snow, had grown considerably.—Till February 3, when the frost set in, the water continued very abundant, but soon after became considerably reduced.—It was now observed that the grass on the part first watered was full six inches long. From the gloominess of the succeeding days the floater had no opportunity of taking off the water to advantage; and it was observed by Mr. Beck, that the grass grew much more in the latter part of January and the first two or three days in February than in March. The want of sunshine in this part of the spring appeared to be the cause of this evident suspension of vegetation; for it has been further observed, that the severity of frosty nights, if the days be fine and sunshiny, does not retard the growth of grasses in a water mead, as it does those on other lands.

March 23, twelve acres of the bed-work were begun to be fed with 201 ewes and 221 lambs; they were continued on the ground till the 10th of May.—April 9, eight acres of the catch-work part were stocked with sixteen cows until the same time, taken into the yard by night, and fed with hay cut from the water mead the preceding year; when the whole was re-

floated for a few days, and shut up for mowing. Mr. Beck omitted no opportunity of applying the water immediately, as each part sufficient for the purpose could be fed, and the stock kept from it by hurdles; and by this management the early fed parts were stocked a second time before they were shut up for mowing at the period above stated.

If the spring feed of the above number of sheep and lambs be estimated at 12s. 6d. per week for seven weeks, it will be worth per acre £4 7s. 6d.

And the hay at two tons do. at the low price of 2l. 10s. each, £5.

The aftermath, or autumn feed, at £1 10s.

It makes the crop worth £10 17s. 6d. per acre.

But it must be remarked that the crop, on account of the recent removal of the soil occasioning the destruction of much grass, was not so productive, and that the future crops will for some years continue to increase.

ANCIENT WATER MEADS.

Since writing the former part of this work I was informed of some ancient water meadows between the villages of Abington and Babraham, in Cambridgeshire, and I went purposely to see them. The feeder crosses the turnpike road from Newmarket to London, at the smallest arch of the two, by Bourn-bridge. The water is diverted from its original channel in the grounds above, belonging to John Mortlock, Esq. and continued for two miles below, through the village of Babraham. The principal feeder which follows the level of the ground in a very winding form, may be

said with the hatches to constitute all the works, for nothing else can be now discovered by any one unacquainted with the construction of water meads. The various grasses and weeds in blossom and in different stages of growth, and of various shades of green, just enabled me to discover that very small catch drains had at sometime been made; but it appears doubtful if they were ever numerous or capacious enough, or properly disposed: most of them do not appear to be of any service to the meadows. The above indications now clearly prove that the water does an infinite good on some parts, and injury for want of proper form on others. The good parts are small indeed, but sufficient to prove the practicability of making all the other equally abundant, besides the addition of an extraordinary crop of good feed in the spring, which by the present rule of putting on the water at Easter is entirely lost. I was informed that the occupiers were afraid of rotting their sheep, and they are therefore contended with the imperfect proceedings, which give them a tolerable crop of hay. These circumstances and the form of the works seem to prove, that they were not designed by any person from Wiltshire, and that the possessors are totally unacquainted with the management and utility of of water meadows in that county.

I was informed that the Pope's Legate bought those manors of Queen Mary, and being versed in the Italian method of irrigation, established these works.

THE CONCLUSION.

*Why many millions pay for grain
From British soil we might obtain ?
With toil and treasure spent in trade,
Our fields might soon be gardens made.
More care to pastures poor extend,
By sheep and kine their herbage mend ;
And where no swath of grass be mown,
There let the yellow corn be sown.*

THE methods of improving poor dry gravelly land, and even the wettest bog, by converting it into water meadow, appear very simple when perfected, and it may be said that they have been practised by persons totally ignorant of the geometrical construction of lines and angles, and wholly unacquainted with the use of the spirit level, yet it must be observed there is much difference in the quality of water meadows like other lands, for many in Wiltshire are unworthy the name, and only prove that such works in the hands of a skilful practitioner might have been rendered more complete and effectual. It is also probable, that the same quantity of water might have improved twice the quantity of ground to double the

value of what has been done by such an imperfect method of proceeding. Carpenters or masons will often assert they can build a good house without the aid of an architect, but such houses are seldom found equally comfortable and convenient with those erected from a well digested plan. The operator in such cases (who has seldom much credit to lose) comforts his employer with the common consolation, that though he has not succeeded the first time he can alter it, but such alterations must be paid for in some way or other, and at last the proprietor is put to a number of inconveniences and unnecessary delays to get his business done ill, and even that at an expence which should have paid for the execution of a proper plan.

To appreciate the value of water meadows no more is wanted than a summary of their benefits. Their crops are produced at the least expence (taken for a considerable time together) and greatest certainty of success. They produce the earliest spring feed and the largest bulk of hay; consequently a greater quantity of cattle can be kept to feed off, and make the best of the produce. The grass is of the most succulent nature, and the best food that can be given to breeding stock; it enables them to produce the most milk for their tender offspring. Every breeder of cattle must know how to value these advantages. The herbage of dry land is impoverished by wanting water, and that of wet land by its remaining stagnant, but both these evils are remedied by irrigation. Winter, when water is most abundant, is proved to be the most proper season for applying the water. The examples enumerated shew,

that no one should be discouraged by vague opinions of improper situations, soil or water. My success in improving lands under all these alledged unfavorable circumstances, is sufficient to warrant an experiment; the result of which must triumph over ignorance and prejudice. Many have not adopted the practice of floating land, probably from not having obtained sufficient information, and many have formed a very wrong conception of its utility. The application of water may be so varied, that I never could be persuaded that perfection was to be confined to Wilts, Dorset or Gloucestershire, but I had good reasons to believe that the beneficial effects of it might be extended to all counties, when once the practice was well introduced; the greatest crops of hay being always procured from those meads which are naturally overflowed every winter. Much as may have been said on manure, it appears that water has the power of producing the greatest quantity: if water meadows want none, but on the contrary contribute to the enrichment of other land, so much extra manure will remain for other parts of the farm, an advantage too great and apparent to require any comment.

It appears by an attentive consideration of the permanent advantages derived from drainage and irrigation, to be much more advisable to improve than to purchase land. Tenants will very readily pay a much greater interest for money so laid out than can be generally obtained by new purchases; and the landlord cannot have a better security for his money, or one obtained at less expence. He has also the advantage of improving his property during the exist-

ence of a lease, which improvements on a new letting may probably be of double or treble the value. On entailed estates certain parts of the rent might be regularly appropriated to such purposes. Mr. Coke, of Norfolk, has given the landed interest the most liberal example of this sort, by continuing to expend five thousand a year in the permanent improvement of property so circumstanced.

Tenants, in their leases, should be compelled to put the water on at proper seasons, to clean all the works, and leave them in good repair, and not suffer heavy cattle on them in a wet state. If a farmer could keep more stock in the months of March and April, he could keep more the remainder of the year. This is the most distressing time to a breeder and grazier. It is evident from what has been done at Prisley bog, that a good system of irrigation is the best practicable plan of draining and making them good. All these advantages, and the inexhaustible supply of manure which is raised to procure the most abundant crops at the least expence, and without a possibility of impoverishment, must surely entitle water-meadow property to the first place in the scale of estimation.



Pl. 3

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